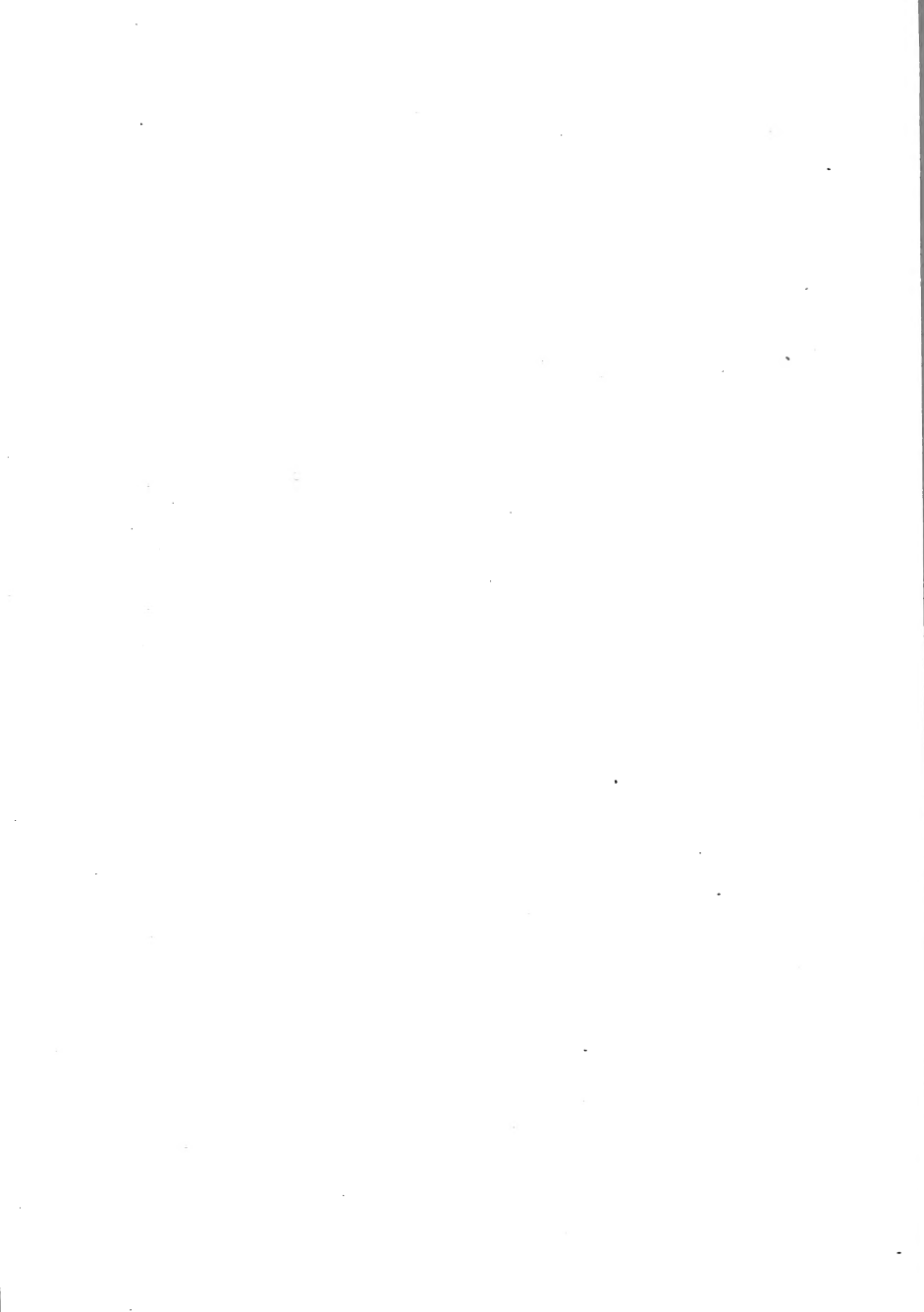
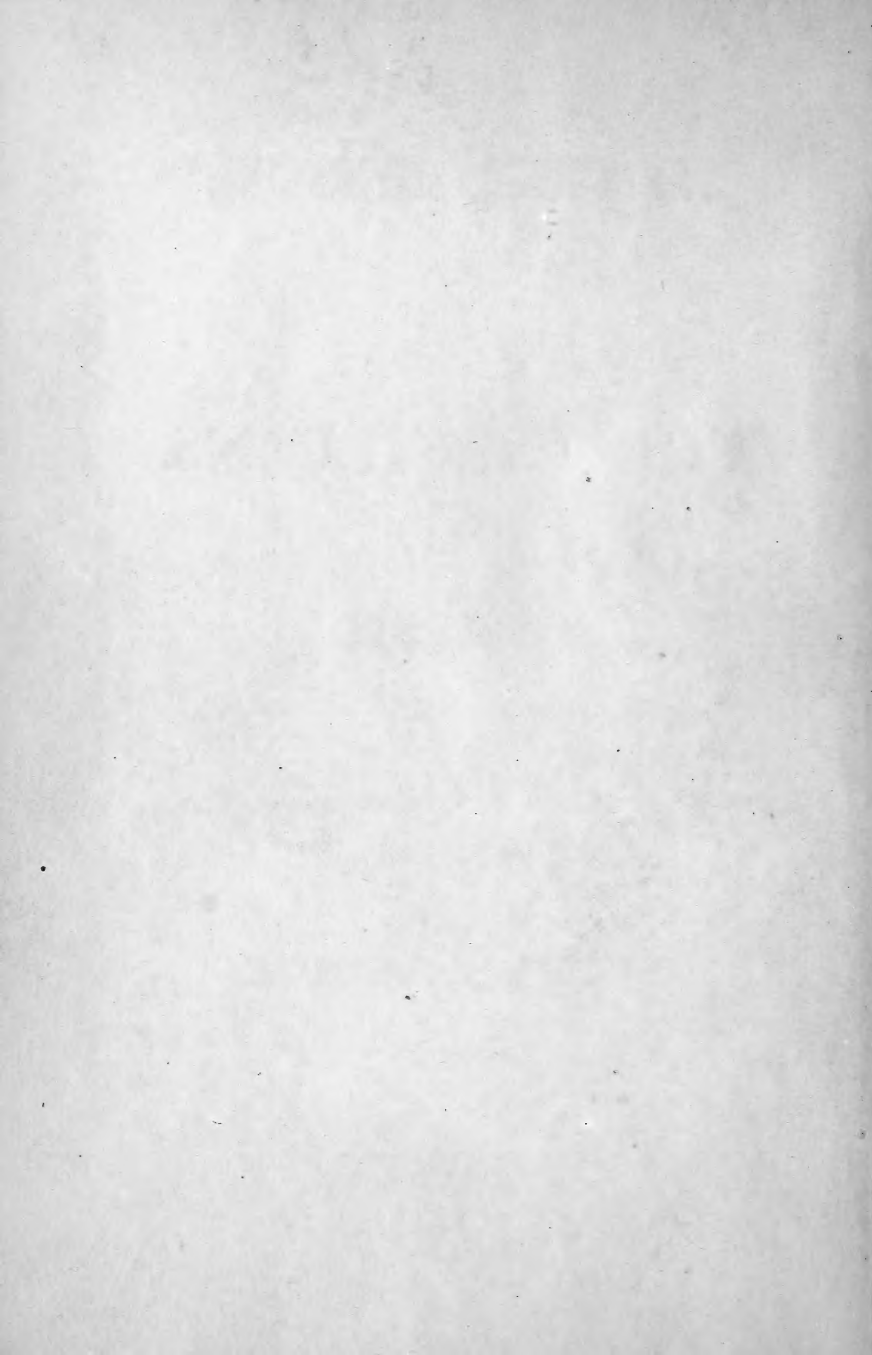


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THE TAILED AMPHIBIANS,

INCLUDING

THE CÆCILIANS.

A THESIS:



PRESENTED TO THE FACULTY OF MICHIGAN UNIVERSITY, BY

W. H. SMITH.

—

1877.



A decorative border with intricate floral and scrollwork patterns surrounds the central text.

PRINTED AT THE

HERALD PUBLISHING HOUSE,

No. 209 Jefferson Avenue, Detroit, Mich.

TO

Prof. M. W. Harrington,

MY ESTEEMED TEACHER AND FRIEND, TO WHOSE CARE,

ZEAL, AND POWER OF INSPIRATION I OWE

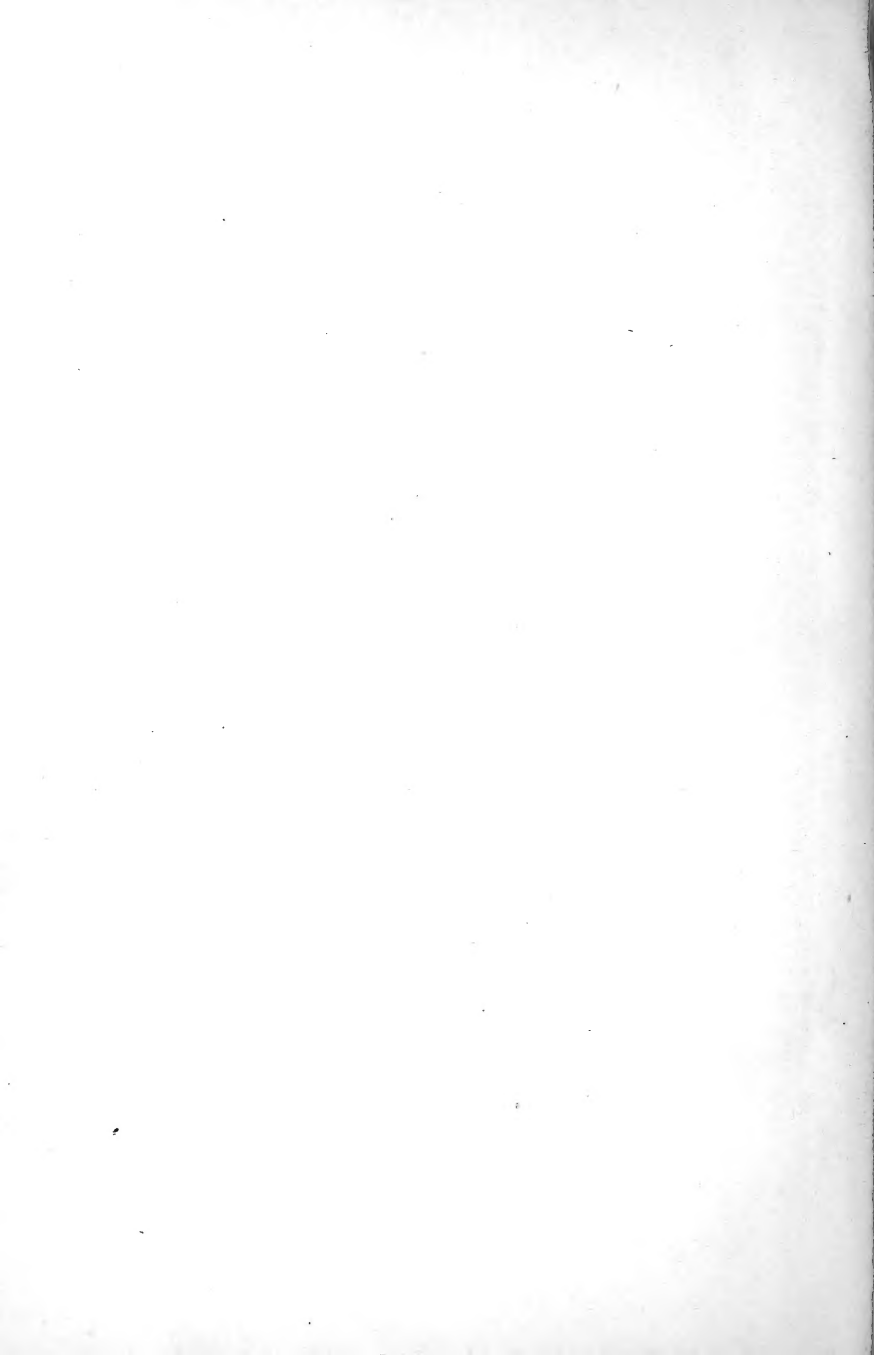
MUCH OF WHAT I MAY BE

IN LIFE,

IN GRAFEFUL RECOGNITION

OF THE MANY FAVORS RECEIVED, THIS LITTLE VOLUME

IS RESPECTFULLY INSCRIBED.



P R E F A C E.

In presenting this thesis the writer would state that it has been his aim to prepare a work which would facilitate the study of these animals. In the effort to accomplish this, he has not hesitated to use the works of previous authors, and as some may wish to know how much has been taken from his predecessors, and others desire the means of fuller investigation, he has appended at the end a list of the works from which he has drawn material. While under more or less obligation to all these authorities, he feels that an especial mention is due to the *Erpetologie generale*, by Dumeril and Bibron; the article *Amphibia* in the *Encyclopædia Britannica*, by Prof. Huxley, and the papers of Prof. Cope.

In addition to the authors cited, he has availed himself of the specimens in the University collection, and so far as possible relied upon these rather than the writings of his predecessors, fully believing that book knowledge, however good, when compared to an examination of the object, is like the dry bones in the prophet's vision. So far as facilities were at hand, the descriptions and characters have been drawn from the object. Where

this was not present, they have been abridged, sometimes almost without change of language, from some previous writer.

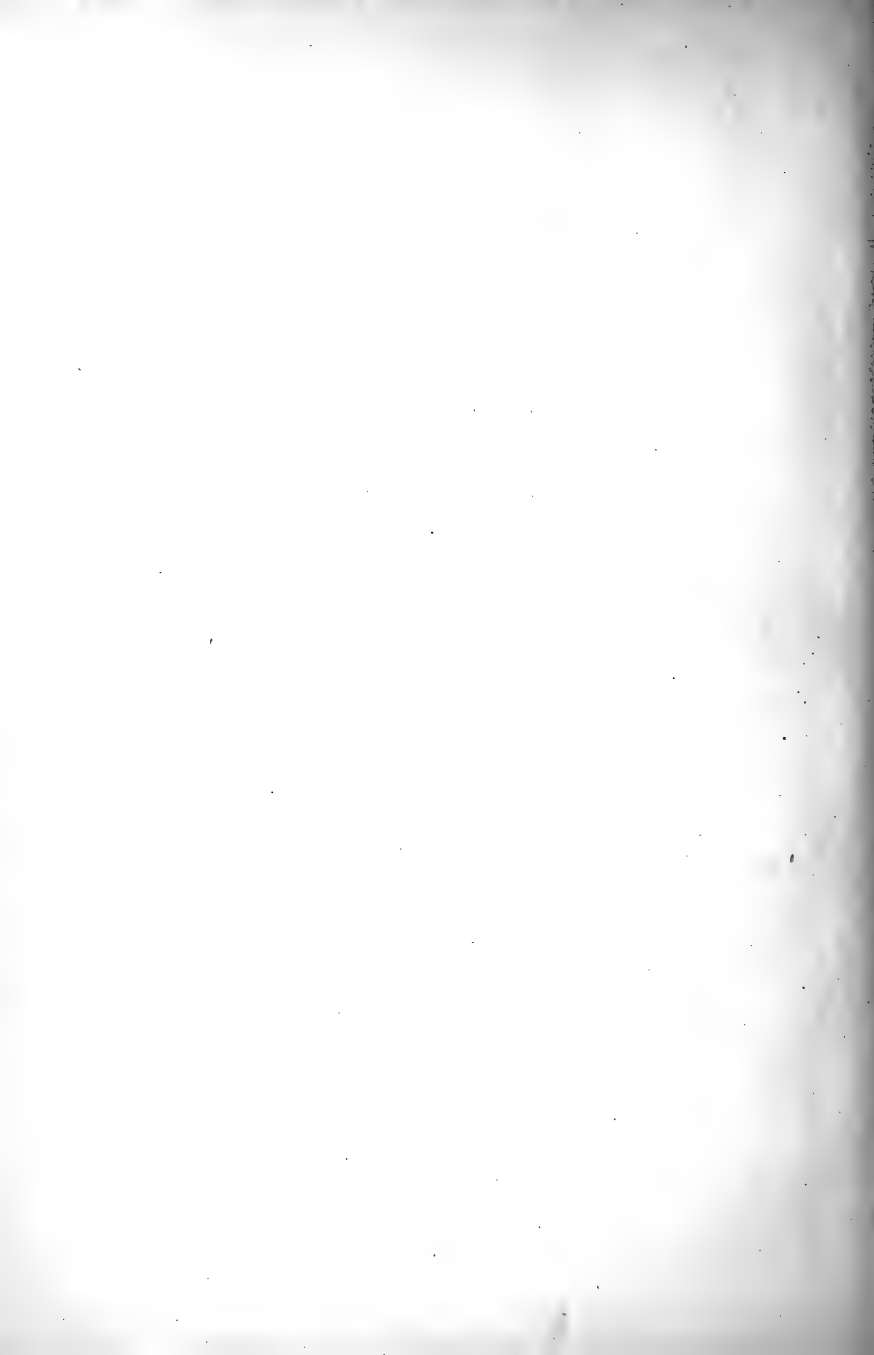
Trusting that this little volume may be a help and a guide to others in the study of these animals, the author presents it, and asks for it a lenient criticism; for none more than he will probably ever realize its imperfections.

ANN ARBOR, May 17, 1876.

EXPLANATIONS.

A number placed after a man's name refers to the list of authors given in the back part, but if placed after the name of an animal, as *Amblystoma punctatum* (14), indicates that in the work cited, in this case, De Kay's *Natural History of New York*, a drawing of the whole, or some part, of the animal will be found.

Narial valvules, a term not generally used, refers to two small hemispherical swellings upon the tongue, which are fitted to the inner nares.



* AMPHIBIA.

Metamorphosis after birth, respiration branchial in young, pulmonary, or pulmonary and branchial in the adult, but always feeble in the lungs while active from the skin; lungs with few cells; blood cold; corpuscles oval nucleated; circulation incomplete; heart in adult with two auricles and a ventricle,† reproduction oviparous or ovoviviparous; fœtus anamniate; allantois wanting, unless the urinary bladder represents it; skin usually naked or unarmed; skeleton incomplete, internal; cranium with two occipital condyles; nasal sacs and pharynx connected; nervous system cerebro-spinal; brain small; cerebellum scarcely visible; excrementitious and reproductive organs opening into a cloaca.

Exclusive of the extinct order Labyrinthodontia, none of which have existed since the Trias, and which is characterized by the labyrinthine teeth, the salamandroid or rarely serpentiform body, and the presence of exoskel-

*For anatomy see 5, 39 b, and 61.

†A question has been raised as to the structure of the heart in the Perennibranchiata. Proteus, and also the Axolotl in all probability have only a single auricle.

etal plates, the following table gives the subdivisions of this class into orders:

- Feet present at least in front; body not vermiform. (a)
 Feet wanting; body vermiform OPHIOMORPHA.
 (a) Adult tailless; body thick. ANOURA.
 (a) Tail always present; body lacertiloid.—URODELA.

URODELA.

CAUDATA, Leuckart.

Body elongated, naked or without exoskeletal plates;* tail compressed or cylindrical, persistent throughout life; feet usually two pairs, rarely only one; radius and ulna, as well as tibia and fibula, not united into a single piece; external opening of the cloaca a longitudinal slit.

Gills persistent throughout life. PERENNIBRANCHIATA.

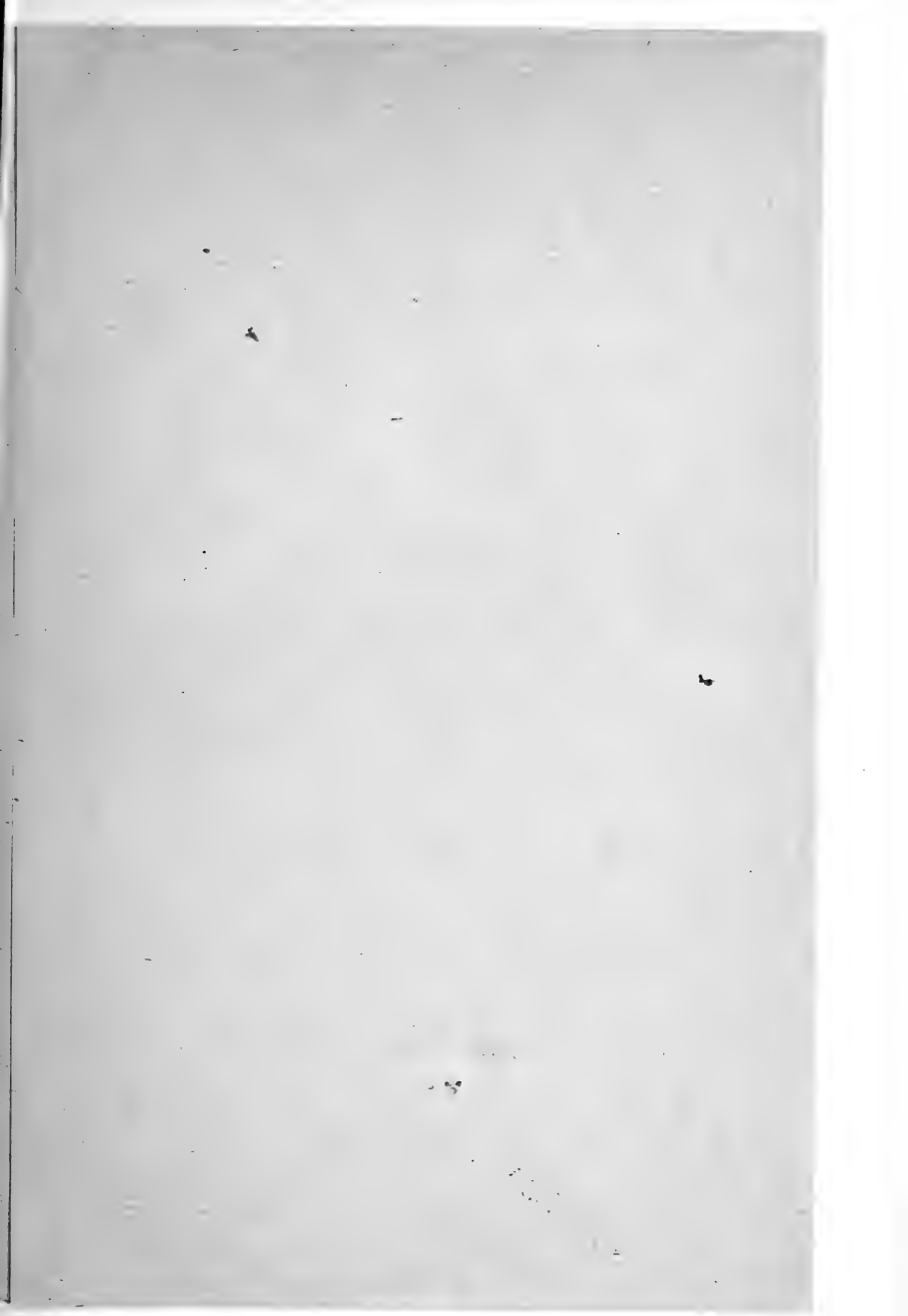
Gills caducous†. CADUCIBRANCHIATA.

Perennibranchiata.

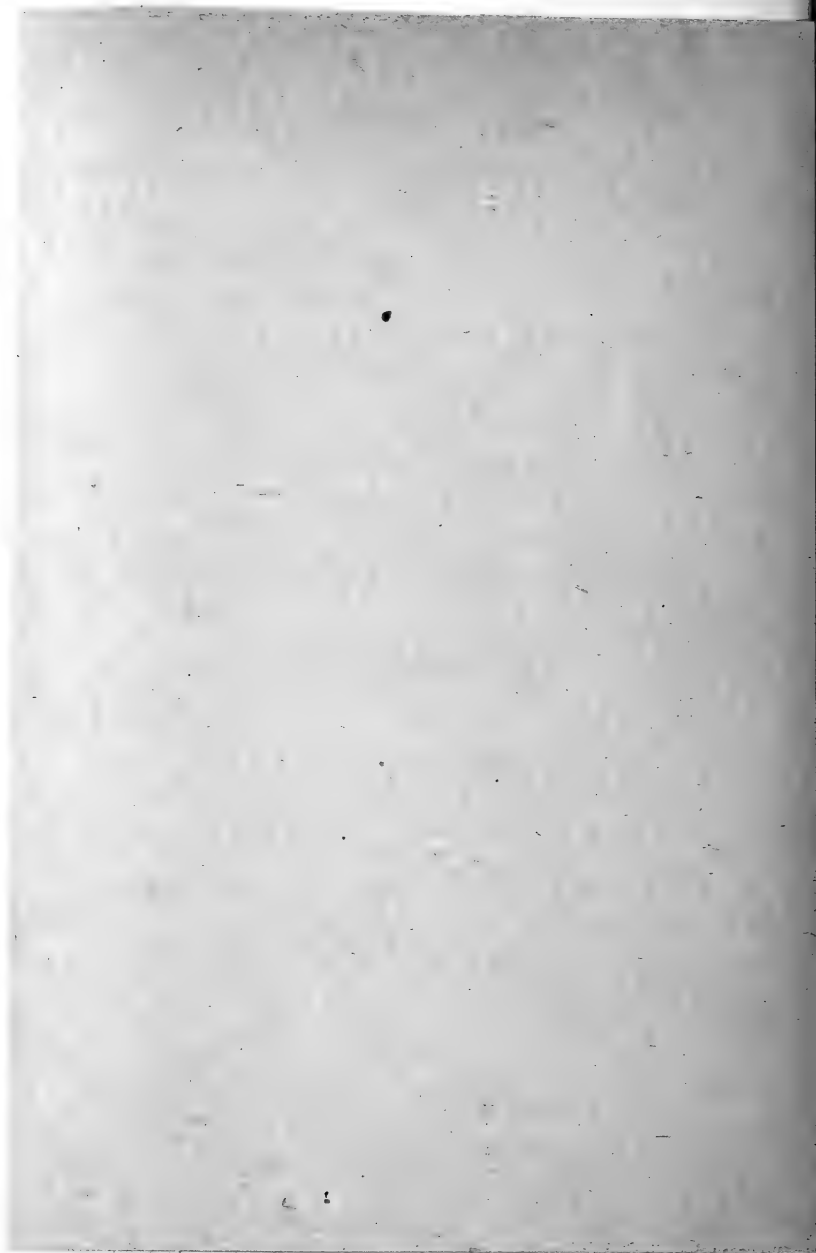
Amphipneusta, Opperl; Proteides, Leuckart, Harlan, Muller, Dumeril and Bibron; Phanerobranchies, Dumer-

*Amphiuma has very fine scales, and in this respect resembles the Cæcilians.

†See at least apparent exception in the case of Siredon.



	TRACHYSTOMA.	PROTEIDA.	AMPHIUMIDA.	MENOPOMIDA.	SALAMANDRIDA.
Skull.	Elongated.	Elongated.	Elongated.	Broad.	Broad.
Præmaxillæ and Dentaries.	Armed with horny plates.	Dentigerous.	Dentigerous.	Dentigerous.	Dentigerous.
Præmaxillæ.	Ananchylosed.	Ananchylosed.	Anchylosed.	Ananchylosed.	Separate or Anchylosed
Maxillæ.	Rudimentary or Absent	Absent.	Large.	Large.	Large.
Nasal Bones,	Absent.	Wanting.	Large.	Large.	Present.
Palatines.	Small Oval and beset with <i>dents en brosse</i> .	With a single row of teeth.	Absent.	Wanting.	Present in young, but changing relation in adult.
Pterygoid.	Absent.	United with Palatines.	Elongated.	Very broad.	Present or absent.
Prefrontals.	Wanting.	Wanting.	Present.	Present.	Present or wanting.
Two Anterior Ceratohyals.	Distinct.	Connate.	Connate.	.....	.....
Vertebræ.	Amphicæulous.	Amphicæulous.	Amphicæulous.	Amphicæulous.	Amphi- or Opisthocæulous.
Carpus and Tarsus	Cartilaginous, the latter wanting.	Cartilaginous	Cartilaginous.	Cartilaginous.	Cartilaginous or Osseous
Branchial Arches	4 Persistent.	3 Persistent.	4 Persistent.	May be reduced to 1st&2d	1st and 2d Persistent.
Pelvic Arch and Limbs.	Absent.	Developed.	Developed though small	Well developed.	Well developed.
Anterior Metacarpal Bones.	5	3	3.	4.	4
Phalanges of 4th Finger.	.....	1	1.	3.	3
Eyelids.	None.	None.	None.	Two.	Two.
Inner Layer of Choroid.	.....	Cartilaginous.	.....	Cartilaginous.	Wanting.



il and Bibron; Pseudophydiens, De Blainville; Sirenideae, Tenney; Ichtyoides, Latreille.

Branchiæ persistent; prefrontal, nasal and maxillary bones wanting; præmaxillæ not ankylosed together; pterygoid absent, or united with the palatines; vertebræ amphicœlous; carpus and tarsus cartilaginous, the latter sometimes absent; eyes without lids, in some cases surrounded by circular ring resembling a lid.

Pelvic arch and limbs wanting. . . TRACHYSTOMA.

Pelvic arch and limbs present. PROTEIDA.

TRACHYSTOMA, Muller.

Skull elongated; parasphenoid edentulous; vomer with teeth; præmaxillæ and dentaries armed with horny plates; pterygoidea wanting; occipital condyles sessile; first two ceratohyals distinct; branchiæ, branchial apertures, and four pairs of arches persistent; eyes surrounded by a circular lid; carpus cartilaginous; pectoral arch and limbs developed, pelvic wanting; anterior digits three or four.

Siren, Linnæus.

Body elongated; vomero-palatine teeth in two groups, converging towards the front, but not united along the median line; tongue triangular, free anteriorly and laterally; head and neck confounded; mouth and eyes small; muzzle round; tail compressed, its basal part confounded with the body.

Toes four; color uniform, without stripes.

S. LACERTINA. (1)

Toes three; color not uniform; longitudinal bands or stripes present... S. STRIATA. (2)

* (1) **Siren Lacertina**, Linnæus.

Synonyms, *Siren operculata*, Beauvois, Cuvier, Latreille, Shaw, Daudin; *Siren intermedia*, Le Conte, Wag-

*For the anatomy of this animal see 61.

ler, Owen, Holbrook, Baird, Rusconi; *Pseudobranchus intermedius*, Gray.

Color dark gray to brownish or bluish black; muzzle, lower jaw, and feet somewhat lighter; head long, rounded; opercula of the gills usually fringed; transverse folds present upon the sides, and similar to the costal folds of many Salamanders.

Length eleven inches.

Habitat Southern States.

Le Conte (44 a) describes and figures as a separate species under the name of *Siren intermedia*, an animal which is probably only a variety of the *lacertina*. The only difference from this to be detected by a careful reading of his description is that it has the opercula of the gills fleshy, undivided and not fimbriated. Its habits, too, resemble both *S. lacertina* and *S. striata*, at times burrowing in the earth like the former, and then at others dwelling in mud and water like the latter.

Siren striata, Le Conte, (44 b)

Synonym, *Pseudobranchus striatus*, Gray.

Body dark with a broad brown stripe on each side; below dotted with dark white, and with two longitudinal stripes paler than those higher up; opercula trilobed; head triangular, with rounded apex; transverse folds upon the sides similar to those of the preceding species; limbs slender; *toes three*.

Length nine inches.

Habitat Southern States.

PROTEIDA, Muller.

Skull elongated; parasphenoid edentulous; vomer with teeth along its anterior margin; præmaxillæ and dentaries dentigerous; pterygoid present and anchylosed with the palatines; occipital condyles sessile; first two ceratohyals connate; branchiæ, branchial apertures, and three pair of arches persistent; eyelids wanting; pelvic and pectoral arches and limbs developed; anterior digits three or four, fourth finger, or in this case the third, the first being absent, with a single phalanx.

Toes, two or three on each foot; trunk very much elongated. **PROTEUS** (1)

Toes four on each foot; trunk short and thick.

MENOBANCHUS (2)

(1) **Proteus**, Laurenti.

Teeth in the upper jaw in four rows converging towards the front, or the two on each side uniting medially with the corresponding rows of the other side; tongue small ovate, free anteriorly and laterally; eyes concealed; muzzle truncate and shaped like a duck's bill; toes three in front and two behind.

But one species is ordinarily recognized as belonging to this genus. Cope (24, 0) however, from characters

of specimens in Prof. Hyrtl's private museum in Vienna, gives the following:

"A. Two condyles on the o. o. supraoccipitale. Longitudinal and transverse occipital crests none. Vertebræ 23 Præmaxillary teeth seven upon each side, no teeth on the o. operculare. From coronoid process to angle of ramus nearly as long as from coronoid to symphysis. Muzzle narrowed, canthus rostralis weak.

ZOISII.

A. A. No condyles on the supraoccipitale.

I. Twenty-three dorsal vertebræ; an occipital crest.

Præmaxillary teeth eight, mandibulars twenty-one, a few operculars. Coronoid process scarcely developed. Muzzle, and hence the o. o. frontalia exceedingly slender; latter with the parietals convex (from drying?)

CARRARAE.

II. Twenty-five to six dorsal vertebræ; a longitudinal occipital crest.

a. No teeth on the o. operculare; præmaxillaries 8-9.

21-2 Mandibulars; from coronoid process to angle much shorter than from former to symphysis; no groove below coronoid process. Muzzle longer than following; o. o. frontalia concave medially, parietalia plane; canthus rostralis strong. XANTHOSTICHUS.

a. a. Teeth on operculare; præmaxillaries 8. Mandibulars 21; from coronoid to angle much shorter than from former to symphysis; groove below coronoid extending anteriorly; muzzle shorter; frontals plane, parietals, and occipitals concave; canthus strong.

SCHREIBERSII.

a. a. a. Teeth on operculare, præmaxillary teeth ten. 9.

Twenty-nine (four) mandibulars; coronoid without

groove below, much nearer angle mandible than symphysis; muzzle long, frontals narrow plane; canthus not strong. ANGUINUS.

Zoisii is the stoutest in proportion to its length. *P. carrarae* is from Dalmatia, while the others are from Carinthia. A specimen like *P. xanthostichus*, but with nine præmaxillary teeth has been named *Freyeri*, and one very near *anguinus* with twenty-four mandibulars, has been named *Haidingerii*."

Cope is not alone in holding the view that there are more than one species of *Proteus*. Freyer* in 1846 claimed two, and Fitzinger† in 1857 described the following seven:

Hypochthon zoisii,
 " *Schreibersii*,
 " *Freyeri*,
 " *Laurentii*,
 " *Haidingeri*,
 " *carrarae*,
 " *xanthostichus*.

The characters however used in distinguishing these are not considered valid, and in the present state of knowledge we seem scarcely justified in subdividing the genus, but rather ought to consider these as varieties of one and the same species. We have then

*Archives fur Naturgeschichte.

†Sitzungsberichte Wien. Acad.

***Proteus anguinus**, Laurenti (12 b)

Body smooth white or grayish rose; skin with mucous pores almost concealed; branchiæ supported by a common peduncle; tail much compressed.

2 **Menobranchnus**, Harlan.

Necturus, Rafinesque, Wagler, Cope, Gray.
Phanerobranchus, Fitzinger.

Upper jaw with two curved rows of teeth, the posterior row nearly parallel to and much longer than the anterior; tongue ovate, large, fleshy, free anteriorly and laterally; toes distinct, four in front and four behind; body short and thick; tail short, much compressed.

† **Menobranchnus lateralis**, Holbrook. (14, 12, b)

Synonyms, *Proteus tetradactyle*, Lacepede; *Triton lateralis*, Say; *Necturus maculosus*, *maculatus*, *luteus*,

*For the anatomy of *P. anguinus* see (45, b) and for the animals living with and serving it as nourishment see (46.)

†Cope (24, o) believes this a young *Spelerpes*, and that it changes to that as *Siredon* to *Amblystoma*.

and fuscus, Rafinesque; *Sirena maculosa*, Rafinesque; *Phanerobranchus cepedii*, Fitzinger; *Siredon hyemalis*, Kneeland and the following probably: *Necturus maculatus*, Baird; *Proteus maculatus*, Barnes; *Menobranchus maculatus*, Holbrook; *Menobranchus punctatus*, Gibbes.

Body cylindrical, smooth, brownish, with darker spots and often a black lateral line; head broad, depressed; eyes moderate; nostrils small; muzzle truncate; teeth large and conical; gular fold very strongly developed; gills red, three on each side.

Length $1\frac{1}{2}$ feet.

Habitat the Great Lakes, Lake Champlain, Ohio and Alleghany Rivers, and Santee River?

Kneeland (47 b and c) states that this animal is nocturnal, feeds upon worms, cannot digest minnows, but has its gills nibbled off by small fish, and hence can survive by cutaneous and pulmonary respiration, Smith (48) confirms Kneeland's view of the pulmonary, as well as branchial respiration, in that he succeeded in inflating one of the pulmonary sacs. He also found a *Libellula* larva in the animal's stomach.

Caducibranchiata.

Branchiæ not present in the adult state; maxillary and nasal bones large; prefrontals usually present; præ-maxillæ separate or ankylosed, and always dentigerous.

Branchial apertures upon the neck open*. (a)

DEROTREMATA.

Branchial apertures closed in adult. (b)

(a) Anterior metacarpal bones three.

AMPHIUMIDA.

(a) Anterior metacarpels four... MENOPOMIDA.

(b) Anterior metacarpels four. SALAMANDRIDA.

AMPHIUMIDA.

Skull elongated; parasphenoid and vomer united, dentigerous on their anterior margin; palatine bones wanting; prefrontals and pterygoids present; præmaxillæ and dentaries dentigerous; maxillæ and nasalia large; præmaxillaries united to form a single piece; parietals laterally prolonged, not contiguous with the prefrontals; fronto-temporal arch none or incomplete; occipital condyles pedicellate; basihyal cartilage present; a pharyngeal slit present on each side of the neck; branchial arches four persistent; gills caducous; eyelid circular; vertebræ amphicœlous; carpus and tarsus cartilaginous; pelvic and pectoral arches and limbs developed, but small; anterior digits two or three; fourth finger with a single phalanx.

*Cryptobranchus forms an exception, being without branchial apertures.

Amphiuma, Garden.

Murænosis, Fitzinger; Chrysodonta, Mitchill.

Vomero-palatine teeth in two longitudinal rows converging in front; tongue triangular, much attached; body very much elongated; neck short; muzzle obtuse; feet small; tail compressed.

Toes upon each foot two.....A. MEANS. (1)

Toes upon each foot three..A. TRIDACTYLUM. (2)

1 **Amphiuma Means**, Holbrook.

Synonyms, *Amphiuma didactylum*, Cuvier; *Chrysodonta larvæformis*, Mitchill.

Body brownish to slate color above, paler beneath; skin smooth; sides with numerous transverse wrinkles; body nearly cylindrical; toes on each foot two; tail short without a distinct ridge rising above its surface.

Length $1\frac{1}{2}$ feet.

Habitat Southern States.

Lives in deep ditches and fresh water lakes.

2 *Amphiuma tridactylum.*

Body widest above, nearly ovate in section; color brown to dark gray, paler beneath; skin transversely wrinkled upon the sides, smooth above, with numerous mucous pores; vomero-palatine teeth nearer together, eyes more distant, than in the preceding species; toes on each foot three; tail short, with a small ridge rising above its surface.

Length $1\frac{1}{2}$ feet.

Habitat South-Western States.

MENOPOMIDA.

PROTONOPSIDÆ, COPE,

Skull broad; parasphenoid edentulous; vomer with teeth along its anterior margin; præmaxillæ and dentaries dentigerous; maxillæ and nasalia large; pterygoid present and very broad; two separate præmaxillary bones; prefrontals and parietals prolonged so as to embrace the frontals; fronto-temporal arch absent; occipital condyles sessile; basihyal cartilage present; gill holes open or closed; branchial arches may be reduced to two: upper and lower eyelids distinct; vertebræ am-

phicelous; carpus and tarsus cartilaginous; pelvic and pectoral limbs well developed; anterior digits four; fourth finger with three phalanges.

Branchial apertures persistent. . . . **MENOPOMA.** (1)

Branchial apertures closed in adult.

CRYPTOBRANCHUS. (2)

1 **Menopoma.**

Palatine teeth in a parabolic curve between the inner nares almost parallel to those of the maxillary; tongue transversely oval; head depressed; eyes small; parotids none; branchial apertures upon the side of the neck persistent; skin naked; limbs short and thick; toes four in front and five behind, the latter membranous; tail compressed shorter than the body.

Menopoma Alleghanensis, Harlan (12, 6)

HELL-BENDER OR MUD-DEVIL.

Synonyms, *Protonopsis horrida*, Barton, Barnes, Cope; *Abranchus Alleghanensis*, Harlan; *Cyptobranchus salamandroides*, Leuckhart; *Eurycea macronata*, Rafinesque; *Molge gigantea* in part Merrem; *Menopoma fus-*

ca, Holbrook ; Salamandria horrida et gigantea, or maxima Barton; Salamandra Alleghanensis, Michaux.

Body somewhat elongated, thick and strong; color slate with dark spots; nostrils moderate well defined; head very broad; internal nares large; two outer toes with large membranous fringes.

Length 2 feet.

Habitat Ohio and Alleghany Rivers, and South Carolina ? not of the Great Lakes.

2 **Cryptobranchus**, Van der Hoeven.

Synonyms, Sieboldia, Bonaparte; Tritomegas, Dumeril and Bibron ; Megalobatrachus, Tschudi.

Palatine teeth in a parabolic curve parallel to those of the upper jaw; tongue much attached; body very large rugose or warty; head depressed, oval; branchiæ and branchial apertures caducous; tail short, compressed, and provided with a crest.

This animal resembles the Salamandrida in respect to its caducous gills, but may be readily distinguished from them by its huge size and the arrangement of the vomero-palatine teeth on the anterior edge of the vomer, instead of the posterior, in a somewhat parabola-formed curve with its convexity to the front.

1 **Cryptobranchus Japonicus**, Schlegel. (5)

Synonyms, *Salamandra maxima*, Schlegel; *Megalobatrachus Sieboldii*, Tschudi; *Sieboldia maxima*, Bonaparte, Gray; *Sieboldia Davidiana* ? Blanchard.

Color ferruginous brown bestrewed with blackish spots; above slightly shaded with green or olive; upper part of the body, and especially the head, with numerous rugosities; mucous pores numerous and secrete a disagreeable smelling humor.

Habitat Japan and China.

Related to the fossil *Andrias* found at Oeningen.

Salamandrida.

Synonyms, *Gradientia*, Oppel, Gray; *Pseudo-sauriens*, De Blainville; *Atretoderes*, Dumeril and Bibron; *Mycotodera* of some authors.

Gill-slits perfectly closed in the adult state; skull broad; palatines present in the young, and arranged as in *Trachystoma* and *Proteida*, but change their relations with the growth of the animal; nasal bones usually large; dentaries and præmaxillæ bearing teeth; limbs four, well developed; anterior toes four; fourth finger

	IIDÆ.	SALAMANDRIDÆ.	PLEURODELIDÆ.
Pref		Present.	Present.
Ptery		Present.	Present.
Wall			
Pariang.		Not Embracing.	Not Embracing.
Orbit a Mem- anall.		Confluent.	
Parous.		Non-dentigerous.	Non-dentigerous.
Occip dyle		Sessile.	Sessile.
Vert		Opisthocœlous.	Opisthocœlous.
Carp		Osseous.	Osseous.
Hind		5	5 or 4.
Front Arc me		None.	Present.

four, well developed; anterior toes four; fourth finger

with three phalanges; eyelids two, an upper and a lower, very distinct.

Dummeril and Bibron contrasted the term *Atretoderes* from *Atratos* without a foramen and deras neck with *Trematoderes*, which they applied to the remainder of the *Anoura*. The latter name etymologically considered seems to be a good one, but unnecessary, as is also its synonym *Immutabilia*, of Fitzinger.

In the subdivision of the Salamandrida various methods have been followed. Hallowell (31, h) recognizes nine families, Cope (24, o), six, Dr. Gray (30, b) in his Catalogue of the British Museum, five, while Prof. Strauch who has lately written "Revision der Salamandriden Gattungen," divides them into *Mecodonta* and *Lechriodonta*, the former comprising those in which the vomero-palatines are so arranged as to diverge posteriorly, and the latter those in which the same teeth show a transverse arrangement, or converge behind. The characters of Cope's families are given in the enclosed table. The genera included by him under each family are as follows: Amblystomidæ—*Amblystoma*, *Ensatina*,* and *Onychodactylus*†; Plethodontidæ—*Plethodon*, *Hemidactylum*, *Spelerpes*, *Geotriton*, *Batrachoseps*, *Anaides*, and the following genera given under other names: *Heredia*, *Oedipus*, *Manculus*, *Thorius*, *Gymnophilus*, *Ophiobatrachus*; Desmognathidæ—*Desmognathus*‡; Hynobiidæ—*Hynobius*; Salamandridæ—*Salamandra* and *Tri-*

*Now included in the genus *Amblystoma*.

†He at a later date was disposed to consider this as belonging to the Plethodontidæ.

‡Equal to part of the genus *Plethodon*.

ton*; Pleurodelidæ — Hemisalamandra, Neurergus, Lissotriton, Lophinus, Euproctus, Cynops, Notophthalmus, Pleurodeles, Glossoliga, and Seiranota.†

The following table it is believed will enable any one readily to refer an animal to its proper genus:

Vomero-palatine teeth transversely arranged or wanting; sphenoidal teeth wanting, or convergent posteriorly; (a)

Vomero-palatine teeth in two longitudinal rows divergent behind or sphenoidals present in two elongated groups, and thus divergent. (c)

a. With a transverse row of teeth between the inner nares. (b)

a. Teeth not in a transverse row, but running obliquely backwards and uniting medially at an acute angle. HYNOBIUS. (9)

b. Tail round at the base. AMBLYSTOMA. (1)

b. Tail compressed at the base.

ONYCHODACTYLUS. (2)

c. Hind toes four on each foot. (d)

c. Hind toes five. (f)

d. Vomero-palatine teeth in a transverse row, rarely wanting; sphenoidals in two longitudinal groups, each consisting of several rows. (e)

d. Vomero-palatine teeth in two longitudinal rows, curved outwardly behind, never in a transverse series; sphenoidals wanting.

SALAMANDRINA. (11)

*His genus Triton only includes part of that of the same name in this work.

†Most of these genera are given in the following pages under other names.

e. Tongue attached in front by a membrane.....HEMIDACTYLIUM. (3)

e. Tongue free all around, boletoid.

BATRACHOSEPS. (7)

f. Sphenoidal teeth in two longitudinal groups of several rows each; vomero-palatines in a transverse series. (g)

f. Sphenoidal teeth wanting; vomero-palatines in two longitudinal rows, never in a transverse series. (j)

g. Tongue attached in front by a membrane. (h)

g. Tongue free all around, boletoid. (i)

h. vomero-palatine teeth in a continuous transverse row; commissure much curved.....ANAIDES. (4)

h. Vomero-palatine series more or less interrupted medially; commissure nearly straight.....PLETHODON. (5)

i. Toes palmate.....GEOTRITON. (6)

i. Toes free.....SPELERPES. (8)

j. Sides salient, owing to the great development of the ribs which sometimes pierce the skin. (k)

j. Sides rounded. (l)

k. Parotids present; tail long, compressed.

PLEURODELES. (12)

k. Parotids none; tail short, subcylindrical.....BRADYBATES. (13)

l. Tongue more or less free behind. (m)

AMBLYSTOMA.

Synonym, *Plagiodon*, Dumeril and Bibron, includes *Xiphonura*, Tschudi and *Heterotriton*, Gray.

Palatine teeth in a transverse, often interrupted row, sometimes in the form of an arch or crotchet; toes, four in front, five behind, never palmate; tongue fleshy, round or long, centrally attached, with lateral and anterior margins free; quadrato-jugal bone wanting; skin smooth, slimy, perforated with mucous pores, especially above the orbits and in the parotid region; costal furrows strongly marked; tail short, round to oval at the base, but compressed towards the extremity; vertebrae amphicœlous; parasphenoid not dentigerous; orbito-sphenoid and pro-otic separated by membranes; posterior margins of palatines bearing the teeth; carpus-tarsus, and basi-hyal ossified in adults.

As Prof. Cope (24, m) has given a very fine analytical table of this genus as well as descriptions of the species I have transferred his table to this work and have abridged many of the descriptions from those given by him and would refer persons desiring a more complete study to his very able presentations of the subject. His analysis is as follows:

I. Series of teeth along the external fissure of the internal nares, Plicæ of tongue radiating from its posterior

portion. Parotid glands not forming an ovoid distinct mass. Four phalanges in fourth toe.*

A. Costal grooves ten;

(a) vomerine series three.

Head broad, width 3.5 to groin; muzzle contracted, external nares much closer than the internal, palatine series convex backwards; tail short, compressed; blackish-brown, grey speckled.....TALPOIDEUM.

B. Costal grooves eleven.

(a) Vomerine series three.

b. No, or one, indistinct, plantar tubercle.

Middle series transverse or concave behind posterior margins of nares; width of head in specimens of three inches greater than one fourth the length to groin in adult 4.7 times; black above with gray fasciæ; larger—

OPACUM.

Teeth as in the last; width of head in small specimens 3.5 to groin, in adults 4.5 times; a strong dorsal groove and longer tail; black above, with a series of round yellow spots on each side the back.PUNCTATUM.

Median series of teeth convex, advancing beyond posterior margin of nares; width of head much less than one fourth length to groin; tail short, no dorsal groove; lead-colored with an inferior lateral and usually superior series of small yellowish spots.....CONSPERSUM.

bb. Two distinct plantar tubercles.

Medium series of teeth straight, nearly divided; external nares much closer together than internal; width of head more than one fourth length to groin; muzzle very

* See exception under A. *mavortium*.

short; tail much compressed; blackish above with large irregular yellow spots, confluent on sides; below yellow.

BICOLOR.

C. Costal grooves twelve; mucous pores on each side the muzzle.

(a) Larger species with two distinct plantar tubercles.

(b) No canthus rostralis; head longer.

External nares as widely separated as inner; frontal and nasal region very convex in transverse section; teeth in four distinct series forming together a V with concave sides projecting between the nares; body long, tail short; color brown.....OBSCURUM.

External nares nearer together than the internal on account of narrower muzzle; brown with usually small spots; brown always predominating; teeth continuous or slightly interrupted externally.....TIGRINUM.

External nares as widely separated as internal; muzzle broad, obtuse; brown, yellow spotted, the yellow spots large, often excluding the ground color; teeth continuous, or slightly interrupted externally.....MAVORTIUM.

External nares as widely separated as internal; muzzle broad, obtuse; dark brown, with vertical spots on sides; teeth in four distinct series, in a nearly transverse line.

TRISRUPTUM.

bb. Canthus rostralis distinct; tail longer than head and body, head shorter.

External nares nearer together than internal; muzzle obtuse, head small, width five times to groin; front convex; vomerine teeth in one series slightly convex forwards; yellow, with irregular brown bands above...

XIPHIAS.

a. a. Smaller species, teeth in three series.

No, or one indistinct, plantar tubercle.

External and internal nares equidistant; width of head 4.5 to 5 times in length to groin; length of eyes 2.5 or a little less in width between anterior canthus of same; tooth series transverse; lead-colored to black, with or without pale or distinct lateral spots. . JEFFERSONIANUM.

Inner and outer nares equidistant; width of the long oval head 5.5 to 6 times in length to groin; length eye fissure 1.75—(to? twice) in width between anterior canthus of same; tooth series slightly convex; lead-colored. uniform. PLATINENUM.

Nares equidistant; width of head 5 times to groin; muzzle contracted; eye fissure 1.66 between anterior canthus of same, once to nostrils; median dental series convex forwards. A broad gray band on vertebral line of tail and body, expanding on occiput; sides dark reddish brown. MACRODACTYLUM.

II. Series of teeth extending to external fissure of inner nares; lingual plicæ radiating from behind; parotid glands forming a distinct ovoid mass.

a. Teeth in three series (no canthus rostralis or plantar tubercles) fourth toe with three phalanges.

Nares equidistant, both approximated: median series of teeth nearly straight short: width of head 4.5 times to groin: eye fissure 1.7 times in width between anterior canthus: limbs large, toes short. Uniform brown.

PAROTICUM.

III. Series of teeth not extending beyond inner line of the nares: lingual plicæ radiating from behind: no distinct parotid mass.

- a. Two series of teeth (canthus rostralis distinct):
no plantar tubercles: fourth toe with three phalanges; twelve costal furrows (species large.)

Vomerine series transverse or directed backwards: muzzle prolonged considerably beyond nares: brown, marbled with dark brown.....TENEBROSUM.

Vomerine series in two sigmoids, which converge in advance of nares: muzzle shortly rounded from external nares: uniform black.....ATERRIMUM.

- a. a. Two series of teeth: fourteen costal grooves:
fourth digit with four phalanges.

Teeth arched between inner nares: head one-fourth to groin (in small sp): eye one-half width between canthus: muzzle broad: outer nearer than inner nares: brown, with a series of lighter spots on upper part of sides: below yellowish: muzzle and tail marbled with the same.

TEXANUM.

IV. Series of teeth not extending beyond inner margin of nares: lingual plicæ radiating from a median longitudinal furrow of the tongue: no distinct parotid mass (species small.)

- a. Two series of teeth (no canthus rostralis): fourth toe with four phalanges.

Mandible shorter than muzzle: head elongate, width between eyes behind equal from same to nares: width of head 6.5 times in length to groin: black, with numerous grey annuli on body and tail.....CINGULATUM.

Mandible longer than muzzle: head short, broad: width between the eyes behind equal from same to end of muzzle: body stouter: width of head 6.5 to 7 times in length to groin; lead-colored with a few grey shades below.....MICROSTOMUM.

While the above is exceedingly valuable, and to some would be all that could be desired, it is probable that the following will be more serviceable to most persons in the determination of species.

Spots large, very different from the usual color. (a)

Spots none, minute, or nearly uniform with the ground color. (l)

a. Plantar tubercles two. (h)

a. Plantar tubercles indistinct or none. (b)

b. Costal grooves 14, vomerine series of teeth two. (f)

b. Costal grooves 12. (e)

b. Costal grooves 11. Vomerine series of teeth 3. (c)

b. Costal grooves 10; vomerine series of teeth 3.
TALPOIDEUM. (5)

c. Color black: spots or bands large: median series of teeth concave behind or straight. (d)

c. Color plumbeous: spots small: median series of teeth convex behind.

CONSPERSUM. (12)

d. Back with transverse bands of gray.

OPACUM (2)

d. Back without transverse bands or gray.
PUNCTATUM. (1)

e. Vomerine series of teeth 3: canthus rostralis distinct: back with a gray line.

MACRODACTYLUM. (7)

e. Vomerine series of teeth two: canthus rostralis none: no gray dorsal line..... TENEBROSUM. (9)

f. Canthus rostralis wanting. (g)

- f. Canthus rostralis distinctly marked.
TEXANUM. (10)
- g. Back and tail with gray rings or bands.
CINGULATUM. (19)
- g. Back plumbeous: sides spotted.
MICROSTOMUM. (8)
- h. Costal grooves 12. (i)
- h. Costal grooves 11: vomerine series of teeth 3.
BICOLOR. (11)
- i. Tail shorter than the body: canthus rostralis wanting. (j)
- i. Tail exceeding the length of the body: canthus rostralis distinct. XIPHIAS. (15)
- j. Vomerine teeth in a nearly continuous line. (k)
- j. Vomerine teeth in four distinct patches.
TRISRUPTUM. (14)
- k. Nares inequidistant: yellow spots usually small. TIGRINUM. (3)
- k. Nares equidistant: yellow spots large. MAVORTIUM. (6)
- l. Plantar tubercles indistinct, or none. (m)
- l. Plantar tubercles two distinct. OBSCURUM. (13)
- m. Costal grooves 12 or more. (n)
- m. Costal grooves 11. PAROTICUM. (17)
- n. Vomerine series of teeth 3, extending to exterior of nares. (o)
- n. Vomerine series of teeth 2, extending only to interior of nares.
ATERRIMUM. (18)
- o. Width of head 4.5 to 5 times the length to groin.
JEFFERSONIANUM. (4)
- o. Width of head 5.5 to 6 times the length to groin. PLATINENUM. (16)

1 **Amblystoma punctatum**, Baird. (14)

VIOLET COLORED SALAMANDER.

Synonyms, *Amblystoma subviolaceum*, Tschudi; *Salamandra subviolacea*, De Kay, Holbrook, Harlan, Schlegel; *Salamandra punctata*, Lacepede, Wagler; *Salamandra venenosa*, Barton, Daudin; *Lacerta subviolacea*, Barton; *Lacerta punctata*, Linnæus; *Lacerta maculata*, Shaw.

Color black, at least above, sometimes slightly purplish, changing to brown in alcohol: two sets of bright yellow spots arranged somewhat in rows on each side of the back: legs also spotted, spots unequal and change to white in alcohol: tail oval, compressed at the end: body cylindrical: head large, depressed: muzzle rounded: skin smooth, perforated with pores: two patches of these on each side of the head, one reaching from the nostril backwards, above and somewhat around the eye, the other in the parotid region: cervical fold strong: another fold present behind the eye, the two connected by a ridge: costal furrows eleven, strongly marked, sometimes with others less marked; furrows behind the leg in the anal region four, and others less prominent upon the tail; back with a longitudinal groove: tail indistinct-

ly furrowed lengthwise upon the side: eyes prominent:
nostrils small distinct.

cervical fold, fold behind the eye and connecting groove,
costal furrows, and furrows in the anal and caudal region

AMBLYSTOMA.	PUNCTATUM.	OPACUM.	TIGRINUM.	JEFFERSONIANUM.	TALPOIDEUM.	MAVORTIUM.	MACRODACTYLUM.	MICROSTOMUM.	TENEBROSUM.
Color. { Above.	Black.	Brown or Black.	Brown.	Brown.	Brown.	Dark Brown.	Brown with Gray Dorsal Longitudinal Band.	Black.	Reddish Brown.
Color. { Below.	Paler.	Dark Slate.	Green and Yellowish White.	Green.	Paler.	Brown.	Brown.	Paler.	Pale.
Spots. { Color.	Yellow.	Gray.	Yellow.	None or Light Blue	Plumbeous Gray.	Yellow.	Grayish White.	Plumbeous.	Dark Brown.
Spots. { Shape.	Round.	Transverse Bands.	Round and Confluent Blotches.	None or Light Blue	Blotched & Marbled	Transverse Elliptical Bands or Blotches	Dots.	Indefinite.	Marbled.
Costal Furrows.	Eleven.	Eleven	Twelve.	Thirteen.	Ten.	Twelve.	Twelve.	Fourteen.	Twelve.
Plantar Tubercles.	Indistinct.	Indistinct.	Two.	One almost indistinct.	.....	Two.	Indistinct.	Indistinct.	None.
Canthus Rostralis.	None.	None.	None.	None.	.....	None.	Distinct.	None.	Distinct.
Vomerine Series of Teeth.	Three.	Three.	One.	Three.	Three.	One.	Three.	Two.	Two.
External and Internal Nares.	Inequidistant.	Inequidistant.	Inequidistant.	Equidistant.	Inequidistant.	Equidistant.	Equidistant.	Inequidistant.	Inequidistant.
Phalanges of Fourth Toe.	Four.	Four.	Four.	Four.	Four.	Four.	Four.	Four.	Three.
Length.	6 inches.	3½ inches.	7 inches.	3⅝ inches.	3.8 inches.	6 1-5 inches.	.....	4 inches.	9.3 inches.
Diameter of Head.	⅝ inches.	15-16 inch.	⅞ inch.	¾ lines.	.52 inch.	7 inches.	.....	4 lines.	1 1-5 inches.
Habitat.	United States.	United States.	United States.	Vermont to Wisconsin.	Illinois and Southern States.	California, Minnesota & New Mexico.	Puget's Sound.	United States.	Oregon and Columbia.

AMBLYSTOMA.	TEXANUM.	BICOLOR.	CONSPERSUM.	OBSCURUM.	TRISRUPTUM	XIPHIAS.	PLATINENUM.	PAROTICUM.	ATERRIMUM.	CINGULATUM.
Color. { Above.	Brown.	Brown.	Plumbeous.	Brown	Brown.	Yellowish Olive.	Plumbeous.	Brown.	Black.	Black.
Color. { Below.	Yellow.	Yellow and Olive.	Paler.	Brownish Yellow.	Brown.	Brighter Yellow.	Paler.	Paler Brown.	Plumbeous.	Black and Gray.
Spots. { Color.	Light.	Yellow.	Yellow.	Bark Brown, barely Visible.	Yellow.	Brown.	Whitish, Indistinct.	None.	None.	Gray.
Spots. { Shape.	.....	Bands and Blotches	Small, Roundish.	Blotches.	Transversely Elliptical Blotches.	Bands and Ventral Spots.	Blotches.	None.	None.	Rings and Specks.
Costal Furrows.	Fourteen.	Eleven.	Eleven.	Twelve.	Twelve.	Twelve.	Twelve.	Eleven.	Twelve.	Fourteen.
Plantar Tubercles.	.....	Two.	Indistinct.	Two.	Two.	Two.	Indistinct.	None.	None.	None.
Canthus Rostralis.	Marked.	None.	.....	None.	None.	Distinct.	.....	None.	Marked.	None.
Vomerine Series of Teeth.	Two.	Three.	Three.	Four.	Four.	One.	Three.	Three.	Two.	Two.
External and Internal Nares.	Inequidistant.	Inequidistant.	.....	Equidistant.	Equidistant.	Inequidistant.	Equidistant.	Equidistant.	Equidistant.	Inequidistant.
Phalanges of Fourth Toe	Four.	Four.	Four.	Four.	Four.	Four.	Four.	Three.	Three.	Four.
Length.	2 3-10 inches.	5 5-6 inches.	31.9 lines.	8 1-6 inches.	6 4-5 inches.	11 inches.	.....	7.2 inches.	6½ inches.	3½ inches.
Diameter of Head.	.....	8¾ lines.	3.7 lines.	11 lines.	4-5 inch.	10½ lines.	.....	¾ inch.	4½ lines.	3¼ lines.
Habitat.	Texas.	New Jersey.	Pennsylvania to Georgia.	DesMoines, Iowa.	Ocate River N. M.	Ohio.	Ohio.	Puget's Sound.	Rocky Mountains.	South Carolina.

the tail; back with a longitudinal groove: tail indistinct-

ly furrowed lengthwise upon the side: eyes prominent: nostrils small distinct.

Length	6 inches.	Head to cervical fold	$\frac{3}{4}$ inch.
Tail	$2\frac{1}{2}$ "	Diameter of body	$\frac{5}{8}$ "
Body	$3\frac{1}{2}$ "	" " head	$\frac{5}{8}$ "

Habitat United States east of the Rocky Mountains.

(2) *Amblystoma opacum*. Gravenhorst. (14)

THE BLOTCHED SALAMANDER.

Synonyms, *Salamandra fasciata*, Green, Harlan Holbrook, De Kay, Storer, Wagler; *Salamandra opaca*, Gravenhorst; *Salamandra Gravenhorstii*, Leuckart.

Color above light clay or ash, with transverse dark brown or bluish bands, sometimes in blotches, and extend from head to tail: below the color is dark slate: head with a triangular spot: in alcohol the animal is a grayish ash, with transverse bands of dark brown or brownish black: tail oval, with indistinct lateral furrows: body nearly cylindrical, thickest in the middle; head large, depressed; muzzle round: mucous pores of the skin numerous, about equally distributed, hence no special patches above the eye and in the parotid region; cervical fold, fold behind the eye and connecting groove, costal furrows, and furrows in the anal and caudal region

as in *A. punctatum*: dorsal longitudinal groove less marked than in that species, but still distinct: eyes small yet prominent: nostrils minute.

Length	3½ inches.	Head to cervical fold	½ inch.
Tail	1½ “	Diameter of body	½ inch.
Body	2 “	“ head	15-16 inch.

Habitat United States east of the Rocky Mountains.

Cope says, “The principal difference in form and structure between this species and *A. punctatum* are seen in the absence of any dorsal furrow, or a less prominence of that on the side of the tail. The limbs are more feeble, the head narrower, etc.” In the eight specimens before me however, all of which came from Southern Illinois, the dorsal groove is very distinct. In a specimen from Ann Arbor it is barely visible. In these the most prominent mark of the species is its color, which differs very strikingly from the *A. punctatum*.

Mann (60) states that this animal lays its eggs in the beds of small ponds, and in some cases the number of these amounts to one hundred and eight. He found them in this situation in summer, and also in November, and always with the male and female curled up over the eggs as if in the process of incubation.

(3) **Amblystoma tigrinum**, Green. (14)

Synonyms, *Amblystoma luridum*, Baird, Hallowell; *Amblystoma episcopus*, Baird, Hallowell; *Salamandra lurida*, Sager;* *Salamandra ingens*, Green; *Salamandra tigrina*, Harlan, Green; *Triton tigrinus*, Holbrook, De-Kay.

Color in alcohol varying from brown to lurid above, plumbeous and yellowish white below, the yellowish white in blotches between the brown and plumbeous, sometimes connected longitudinally: spots varying from reddish brown to white, yellow in fresh specimens, extending from the head to the tail and scattered irregularly: tail oval: body cylindrical in some, in others thickest in the middle, and tapering both ways: head depressed: muzzle round; skin smooth with numerous mucous pores: cervical fold and fold behind the eye with connecting parotid ridge: costal furrows eleven, strongly marked, and others becoming indistinct; furrows behind the legs gradually ceasing, so that the end of the tail is smooth: back with longitudinal groove: tail without any indication of lateral furrows: eyes prominent: nos-

*Dr. Sager believes his *A. luridum* distinct from *tigrinum*. If so the above description is that of *luridum*, and I have not seen the *tigrinum*.

trils small, distinct: plantar tubercles two, well developed.

Length	7 inches.	Head to cervical fold	1 in.
Tail	3 "	Diameter of body	1 "
Body	4 "	" " head	$\frac{7}{8}$ "

Habitat Michigan to Minnesota, Nebraska, Louisiana and New Jersey.

Hoy (59) states that this animal moves very slowly upon land, but is very active in the water. Insults offered to its mouth or eyes are resented by strokes of the tail. They are nocturnal in habits; remain in concealment during the day, are sometimes found in cellars after a wet night, and probably only quit the water in the fall to seek more congenial winter quarters.

4 *Amblystoma Jeffersonianum*, Green. (14)

THE GRANULATED SALAMANDER.

Synonyms, *Salamandra granulata*, De Kay; *Triton niger*, De Kay; *Xiphonura Jeffersoniana*, Tschudi, Gray; *Salamandra Jeffersoniana*, Green, Holbrook, Harlan, Schlegel; *Amblystoma fuscum*, Holbrook; *Amblystoma laterale*, Hallowell.

Color black to greenish in alcohol, above greenish slate, without blotches or spots, below of a grayish green tinge; cervical fold white; tail roundish oval; body cylindrical, much longer and slimmer than *A.*

punctatum; head elongate, apparently not separable from the body; muzzle round; mucous pores of the skin distributed over the body generally, and not collected in special groups; cervical fold indistinct, but its place marked by a white band; fold and connecting ridge behind barely discernible; costal furrows thirteen, less marked than in *A. punctatum*, but nevertheless distinct or at least their place represented by a whiter color; furrows behind the leg also less prominent, and extending almost to the tip of the tail; dorsal longitudinal groove nearly or quite indistinct; lateral caudal furrows wanting, but a subcaudal extends from anus to tip; eyes small but prominent; nostrils minute.

Length	3 $\frac{5}{8}$ inches.	Head to cervical fold	7-16 inch.
Tail 1	9-16 "	Diameter of body	$\frac{3}{8}$ "
Body 2	1-16 "	" " head	5-16 "

Habitat Vermont, Pennsylvania, Southern Illinois, Wisconsin, North Shore Lake Superior, and the country included.

5 *Amblystoma talpoideum*, Gray.

Synonym, *Salamandra talpoidea*, Holbrook, De Kay.

Color brown above, paler beneath, blotched or marbled with grayish spots; back and tail with dark spots; tail roundish oval, without lateral groove; body depressed; head slightly wider than the body; canthus rostralis not well defined but present; mucous pores numer-

ous, a prominent row passes interior to the eye; cervical fold distinct; costal furrows ten; eyes prominent but small; nostrils minute.

Length 3 4-5 inches. Head to cervical fold .55 inches.

Tail 1½ " Transverse diameter
of head .52 inches.

Body 2.3 " Length of hind leg 1.7 "

Habitat Illinois to the Gulf of Mexico.

6 *Amblystoma mavortium*, Baird. (13.)

Synonyms, *Amblystoma proserpine*, Baird; *Amblystoma maculatum*, Hallowell; *Amblystoma nebulosum*, Hallowell; *Camarataxis maculata*, Cope; *Amblystoma Californiese*, Gray; *Desmiostoma maculatum*, Sager; *Siredon lichenoides*, Baird.

Color dark brown, paler to yellow below, with yellow caudal and dorsal spots or blotches, and lateral ellipsoid bands extending transversely; limbs blotched; costal furrows less marked than in *Amblystoma punctatum*; tail ensiform; body stout; head large, very broad; muzzle rounded; vomerine series of teeth forming an angle with the apex in front; Hallowell (31, b) says "arched in four patches, the two middle convex anteriorly, nearly in contact;" digits triangular, depressed; males with a fin at upper base of tail in the breeding season; anal region swollen.

Length	8¾ inches.	Head to cervical fold	1 inch.
Tail	4	“	Transverse diameter of head
Body	4 ¾“	“	“ “ body

Habitat California, Nebraska, New Mexico, and the region of the Rocky Mountains.

Siredon lichenoides, Bd. is here placed in the list of synonyms because the recent observations of Prof. O. C. Marsh (37) on the specimens from Lake Como, so confirmatory of and more explicit in regard to species than those made by Dumeril, (32) leave no doubt that it is simply an undeveloped larva of this species. Baird's description (27, c) which is still valuable as giving the characteristics of the young, is as follows: "Body uniform blackish brown, covered all over with licheniform patches of grayish yellow; snout rounded; tail compressed and lanceolated; toes broad and short."

7. *Amblystoma macrodactylum*, Baird.

Color in alcohol brown, with dorsal stripe of grayish brown extending from head to the end of the tail; dark brown spread over the animal from this stripe to the belly, and a few spots occur in the stripe; lateral grayish white dots present, and sometimes extend to the limbs; tail somewhat compressed; costal furrows twelve; body cylindrical, depressed; head depressed and elongated; palatine teeth in three or four patches; transverse

diameter of head three-quarters the distance from muzzle to cervical fold, eyes prominent; nares equidistant.

Length $4\frac{1}{3}$ inches.

Habitat Oregon and Washington Territory.

8. *Amblystoma microstomum*. Cope.

Synonym, *Triton porphyriticus*, (?) Holbrook.

Color in alcohol brownish black, paler beneath; plumbeous spots of indefinite outline scattered thickly and irregularly over the sides, sometimes wanting, at others licheniform; tail round or nearly so at the base, but becoming ensiform towards the end; body slender; length about thirteen times its greatest diameter; head narrower than and not separable from the body; projection of upper jaw not as great as that of the lower; dorsal furrow present, but not deeply indented; mucous pores of the head not different from those of the body; lingual longitudinal furrow present.

Length	4 inches.	Head to cervical fold	.45 inch.
Tail	$1\frac{1}{2}$ "	Diameter of head	.31 "
Body	$2\frac{1}{2}$ "		

Habitat Illinois and Ohio to Louisiana and Arkansas.

This species very closely resembles *Plethodon glutinosus*, but is distinguished from it by the arrangement of the teeth in a transverse uninterrupted row arched in front instead of being separated by a wide interval, and also by the tail being very much compressed laterally:

while in the *glutinosus* it is cylindrical or only slightly compressed. The *Triton porphyriticus* of De Kay is probably *Plethedon glutinosus*.

9. *Amblystoma tenebrosum*, Baird and Girard.

Color in alcohol uniform chestnut brown, marbled with darker brown, and head with a grayish tinge; body cylindrical, depressed; head nearly elliptical; skin corrugated; tail short tapering, much compressed, edges near the tip sharp; limbs relatively strong; fingers short, depressed, the third longest, with a kind of bulb on the under surface; vomerine teeth in two groups, both convex in front, uniting at a slight angle with the apex backwards; animal as a whole "especially characterized by its massive frame and huge size among true Salamanders."

Length	9.3 inches.	Head to cervical fold	1½ inches.
Tail	3.65 "	Breadth of head	1.15 "
Body	5.65 "	Expansion between toes on	
		opposite sides.	3 3-5 inches.

Habitat Oregon.

10. **Amblystoma Texanum**, Matthes. (13)

Synonyms, *Salamandra Texana*, Matthes.

Color above brown, laterally and below yellow; a series of light spots on each side near the back, one corresponding to each costal fold; other spots scattered irregularly over the sides and legs; body subcylindrical, slender; tail long, tapering; head oval, broad, somewhat depressed; vomerine series of teeth arched; tongue not grooved; limbs ordinarily strong; costal grooves fourteen, well marked; cervical and cephalic folds slight but distinct; eyes and nostrils of average size.

Length 2.31 inches.

Habitat Texas.

11. **Amblystoma bicolor**, Hallowell.

Color blackish above, yellow beneath, olive in the middle, yellow upon the sides in spots or blotches; limbs transversely banded; tail yellow with dark spots; muzzle marked and spotted; parotid region yellow; body strong; head large; feet somewhat depressed; tail compressed but thick and rounded at base; vomerine teeth in three series, sometimes brushform; posterior nares

small; dorsal longitudinal groove present, but faint skin smooth; cervical and cephalic folds poorly developed.

Length 5.85 inches. Head to cervical fold .81 inches.

Tail 2.65 " Breadth of head .73 "

Habitat Beesley's Pt., New Jersey.

Hallowell (31, b) says, "perhaps the young of *Amblystoma tigrinum*." However the eleven costal folds, the non-emarginate tongue, and the dentition seem to indicate a separate species.

12. *Amblystoma conspersum*. Cope.

Color above cinereous brown or plumbeous finely speckled with white, below dirty white; sides with indistinct light colored spots; muzzle sometimes marbled at the end; body much compressed; dorsal groove indistinct; costal grooves eleven; tail compressed throughout its whole length; head large, oval; vomerine teeth in three groups, the middle longest; tongue elliptical; limbs short, digits long and slender; skin smooth, visible mucous pores few upon the body, but many upon the tail; species resembles *A. Jeffersonianum*.

Length 31.9 lines. Head to cervical fold 4.3 lines

Tail 12.6 " Breadth of head 3.7 "

Habitat Pennsylvania to Georgia.

13. *Amblystoma obscurum*, Baird.

Color above and laterally brown, beneath brownish yellow; sides with darker vertical blotches barely perceptible; tail similarly marked; head very broad; gape unusually large; inner nares and tongue large, the latter broader than long; vomerine series of teeth four, V form the angle anterior and interrupted along the median line, branches reaching to the anterior border of inner nares; inner anterior series about twice the length of the external ones; skin much corrugated; costal grooves twelve; tail compressed.

Length 8 inches, 2.15 lines. Head to cervical
fold 12.75 lines.

Tail 3 " 2 " Breadth of head 10.9 lines.

Habitat Des Moines, Iowa.

14. *Amblystoma trisruptum*, Cope.

Color in alcohol dark blackish or bluish brown; a single series of large, yellow, transversely elliptical blotches extending from the neck to tip of tail, and a round one just behind the eyes; body strong; head

broad, ovate, much depressed; muzzle pointed; vomerine teeth in four groups, with large intervals; nares equidistant; tongue broader than long; tail compressed towards the tip with sharp edges; skin granulated; mucous pores as usual; certain particles noteworthy in the parotid region.

Length 6 4-5 inches. Head to cervical fold .9 inch.

Tail 3 " Breadth of head 4-5 "

Habitat Ocate River, N. M.

15. *Amblystoma xiphias*, Cope.

Color yellowish olive, brighter yellow beneath; sides and back with brown anastomosing or reticulating bands; head small; cheeks swollen; eyes rather small but distinct; mandible projecting; outer nares nearer together than the inner; tongue large; vomerine teeth V form, at an obtuse angle, interrupted along the median line, and limbs of the V curve; tail oval, crestless, grooveless, longer than the body, compressed from the base and not elevated; digits triangular, depressed.

Length 11 $\frac{1}{4}$ inches. Head to cervical fold 1 inch.

Tail 6 " Breadth of head. .88 "

Habitat Columbus, Ohio.

16. **Amblystoma platinenum**, Cope.

Color plumbeous, paler beneath, with numerous indistinct whitish blotches; body elongated; head oval; muzzle rounded; nares equidistant; dermal cryptæ present in the parotid region; breadth of head five-sevenths the distance from muzzle to cervical fold; vomerine teeth in three patches; angle of the eye anterior to that of the mouth; mucous pores in series along superciliary, also behind and below the orbit, and in the parotid region.

Habitat Northern Ohio.

17. **Amblystoma paroticum**, Baird.

Color reddish brown, paler beneath; immaculate; body strong, rounded and depressed; tail oval, tapering towards the tip, compressed, edge below sharp; head depressed; nares about equidistant; vomerine teeth in four groups, with angle anterior; tongue moderate,

nearly circular; eyes very large and prominent; neck constricted; limbs large; digits long, linear, and not triangular; costal furrows eleven.

Length 7.2 inches. Head to cervical fold .95 inch.

Tail 3.4 " Breadth of head $\frac{3}{4}$ "

Habitat, Puget's Sound.

17. *Amblystoma aterrimum*, Cope.

Color above black, plumbeous beneath; body strong; tail short, upper edge and posterior half compressed; head oval, broad; tongue large, as broad as long; vomerine series of teeth in two groups, beginning behind the inner nares, passing in a curve to the anterior, then turning towards the median line at a right angle to their previous direction; nares equidistant; cervical fold prominent; parotid mass or ridge invisible; costal folds twelve, indistinct; limbs strong; palms wide, toes short, depressed.

Length $6\frac{1}{2}$ inches. Head to cervical fold $1\frac{23}{4}$ lines.

Tail $2\frac{1}{2}$ " Breadth of head $9\frac{3}{4}$ "

Habitat Northern Rocky Mountains.

19. *Amblystoma cingulatum*, Cope.

Color in alcohol black, beneath speckled with gray; transverse dorsal gray bands present, and extend down the sides between the costal folds, sometimes branching and meeting on the back so as to enclose an area; annuli present from the orbits to tip of tail; body very slender; head long, ovoid; muzzle long, projecting beyond mandible; tongue oval, elongate, with a deep longitudinal furrow; row of vomerine teeth convex in front, not extending beyond inner margin of internal nares; gape of mouth short; external nares three-fifths as far apart as the internal; cervical, parotid, and cephalic folds well marked; body elevated in scapular and pelvic regions; tail compressed, carinated above, and towards the tip below; digits slender, depressed.

Length $3\frac{1}{2}$ inches. Head to cervical fold 6 lines.

Breadth of head 3 1-5 lines.

Habitat Grahamville, South Carolina.

ANIMALS KNOWN ONLY IN THE LARVAL STATE.

While the following species have hitherto been referred to a distinct genus, the researches of Dumeril, Marsh, and Tegetmeier render it probable that they are only immature forms, and probably as suggested by Cope in regard to the first, they all belong to the genus *Amblystoma*. At the same time it should be borne in mind that no one has ever seen a species of true Axolotl, such as *Siredon Mexicanus*, undergo metamorphosis, all the observations recorded on this point having been with *Siredon lichenoides*, which soon after naming by Prof. Baird, was suspected of being a larval form. Still further, in all the collections brought from Mexico not a single *Amblystoma* has ever been obtained south of the 26th parallel, while the Axolotl inhabits the Lake of Mexico. Dumeril has also shown that the *Siredons* were capable of reproduction, while so far as our present knowledge goes, the metamorphosed *Amblystoma* is always barren. These facts leave still room for doubt as to whether these animals undergo transformation. And yet while no specimen has ever been observed showing a tendency to a change, their relation to an animal on which observations have been made is such as to render

a metamorphosis in their case exceedingly probable under favorable conditions. In naming them here the generic term, Siredon, though perhaps inappropriate, is retained where a better has not been given, because when the adult is discovered, it will probably be some already well known Salamander, and in the present state of science to assign them new designations would only add to the already burdensome list of synonyms. Also the characteristics of Siredon are still valuable as referring to the young, and hence are given as follows.

Siredon, Wagler.

AXOLOTL, rarely ATOLCALT.

Body short and thick; head depressed; tongue small; vomerine teeth numerous, small, disposed obliquely to the palatine and pterygoid bones; trunk short, slightly compressed; external branchial tufts three, partially covered at base by a floating skin; gular folds representing the operculum; feet four, well developed; toes free, four in front, five behind; tail compressed, not separable from the body.

Amblystoma Mexicanum, Cope.

Synonyms, *Gyrinus Mexicanus*, Shaw and Nodder; *Siren pisciformis*, Shaw, Daudin, Home and Mayer; *Gyrinus edulis*, Hernandez; *Lusus aquarum*, Nieremberg; *Piscis ludricus*, Hypochthon *pisciformis*, Gravenhorst; *Axolotes guttatus*, R. Owen; *Axolotes maculatus*, Gray; *Siredon Humboldtii*, Dumeril and Bibron.

Color brown or dark gray; irregularly black spotted, extending upon their borders in radial lines; tail and belly also spotted; dorsal membrane and upper caudal united, the latter curved; subcaudal fin smaller and nearly straight.

Hernandez was certainly the first to discover this animal, and his allusion to it was so singular as to have been transcribed by naturalists. As it may be of interest to some it is given here.

“*Illuvies menstrua et Lubricus gestus unde nomen meruit Axolotl id est Lusus aquarum. Genus quoddam est piscium lacustrium, molli cute intectum, ac Laceratarum more quadrupes, dodrantis longitudine, pollicem que crassum et si interdum cubitum exedat. Vulvam habet mulieri similliman, ac venter ejus maculis fuscis distinguitur. Corpore medio ad caudam usque, mempe*

prolixam et qua juxta finem tenuissima sit, paulatim ac sensim graciles sit. Pro lingua est Cartilago brevis ac lata. Quaternis natat pedibus, in totidem digitos per similes Ranarum fissis. Caput depressum et reliqui corporis proportione magnum. Hiscens rictus, aterque color. Huic menstrua singulis quibusque mensibus fluere observatum sæpe sæpius est, haud aliter ac mulieribus, etc., etc.

Salubre et gratum præbet alimentum—postea de Condimentis.”

Siredon Harlanii, Dumeril and Bibron.

Synonyms, *Axolotes maculatus*, Owen; *Siredon maculatus*, Baird.

Color ashy gray, with numerous, round, distinct, black spots, beneath immaculate; dorsal membrane rising upon the nape.

Length 8 inches.

Siredon Dumerili, Duges. (39)

“Lower parts much lighter than the upper; throat and breast sometimes white; four white spots upon the

sides. In the male the dorsal crest commences between the shoulders; some sunk points upon the skin, chiefly above; these are openings of the glands which secrete a lactescent, bitter and fetid humor." Duges. (39)

2. **Onychodactylus**, Tschudi.

Synonym, *Dactylonyx*.

Vomerine teeth in a transverse, medially interrupted, row behind the inner nares; sphenoidals wanting? tongue round, entire, free only at its borders; skin smooth, perforated with mucous pores; tail long, round, but distally compressed; digits distinct, four in front and five behind, terminating above usually in a black nail-like spot.

The name of this genus, derived from *dactylus* nail and *onyx* finger, has reference to this last characteristic; but an interesting fact is that a similar spot is often present in large *Amblystoma*, and it seems to be merely incidental, varying with age and the seasons.

1. **Onychodactylus Schlegeli**, Tschudi. (12)

Synonyms, *Onychodactylus Japonicus*, Bonaparte, Gray; *Salamandra Japonica*, Houttuyn; *Salamandra unguiculata*, Schlegel.

Color dark brownish gray, lighter beneath, often marbled with yellow; back with a large reddish yellow band extending from the occiput to the middle of the tail; margins of the band irregularly notched, and the stripe itself bifurcate upon or posterior to the inter scapular region; head short; eyes prominent; muzzle round; parotid mass distinct, separated into two parts by a line from the commissure; postorbital and gular fold well marked; costal furrows fourteen; limbs and body strong; digits long and slender, ending in a kind of pellicle.

Habitat Japan.

3. **Hemidactylum**, Tschudi.

Desmodactylus, Dumeril and Bibron.

Vomerine teeth in two rows, one on each side behind

the inner nares, sphenoidals also in two groups, separated from the former and each other; tongue oval, *adherent in front*; parietal bones osseus; præmaxillaries two, fontanelle wanting; toes rudimentary, palmate at base, four in front and *four behind*.

1. **Hemidactylum scutatum**. Schlegel.

Synonyms, *Salamandra fusca*, Green, Jour. A. N. Science, Phil. 1818, page 357, not Rafinesque; *Salamandra scutata*, Schlegel; *Salamandra melanostica*, Gibbes; *Desmodactylus melanosticus*, Dumeril and Bibron.

Color above brown, muzzle yellowish, limbs and tail orange brown; upper surface with black spots on each side scattered irregularly; beneath white, with pitchy black spots especially numerous in the gular region; head large; muzzle obtuse; eyes not very prominent; iris yellow; pupil black; gular fold well developed; costal furrows well marked; *skin of the back similarly cut* making it resemble scutæ; body cylindrical, short; limbs slender; tail round at base, compressed distally,

equal to once and sometimes twice the length of the body.

Length 2 3-5 inches.

Habitat Abbeville, South Carolina.

Found in April under old logs and rails in open woods at some distance from the water, and was very quick and lively.

4. **Anaides**, Baird,

Vomerine series in a continuous row, sphenoidals in two groups contiguous in front; tongue adherent anteriorly; maxillary teeth lance-shaped, large, but becoming smaller and disappearing posteriorly; præmaxillary bones united into one; *commissure much curved* as a result of the arching of the maxillary bones; toes distinct, four in front and five behind.

Approaches *Plethodon* in many respects, but differs from it in its powerful dentition, curved commissure, continuous vomerine teeth, cutting edge of its maxillary, and its single præmaxillary embracing a fontanelle.

Size large, digits short, distinct; top of head and dorsal region brown, with irregular yellow spots.

A. LUGUBRIS. (1)

Size small; digits long; thumb indistinct; top of head and dorsal region with serrate band. . . . A. FERREUS. (2)

1. **Anaides lugubris**, Hallowell.

Synonyms, *Salamandra lugubris*, Hall, Hallowell;
Taricha lugubris, Gray.

Color brown above, with numerous irregular yellow spots extending from the occiput to tip of tail, spots sometimes nearly in rows, beneath yellowish, unspotted, head large; muzzle truncate; nostrils distinct; eyes prominent, situated far in front of the posterior part of the commissure; gular fold distinct, others anterior to axilla barely visible; costal grooves thirteen, prominent; tail small round, tapering and annulate; body and limbs strong.

Length $5\frac{1}{4}$ inches.	Head to gular fold 7-8 inch.
Tail $2\frac{1}{4}$ " "	" " axilla 1 "
Body 3 " "	Breadth of head $\frac{1}{2}$ "

Habitat California and Oregon.

Found in spring under logs.

2. **Anaides ferreus**, Cope.

Color above and upon the tail black, nape and sides greenish gray, beneath dark yellow, immaculate; limbs black above, lighter or brown below; head eccentric

oval; muzzle truncate: nostrils joined to the commissure by a delicate furrow; vomerine teeth eight, on an arched ridge; outer nares farther apart than the inner; gular fold prominent; costal furrows fourteen; body slender, cylindrical; limbs appressed; digits long and slim; thumb with a short phalanx, but not distinct.

Length 3.65 inches.

Head to axilla .7 inch.

Tail 1.65 "

Breadth of head .28 "

Habitat Oregon.

5. **Plethodon**. Tschudi.

Phatnomatorhina, Bibron; Plethodon and Desmognathus, Baird, Cope.

Vomerine teeth in two patches, one behind each of the inner nares rarely wanting; *sphenoidals numerous in two almost quadrilateral groups*; tongue large, round, or oval, entire or slightly notched behind, *adherent in front* and centrally, laterally and posteriorly free; skin smooth; body cylindrical; tail round tapering to the tip; toes four in front and *five behind*; præmaxillaries two.

With the exception of *Plethodon persimilis*, the exact position of which is doubtful, the following table will serve for the determination of the species:

Sphenoidal teeth in two medially contiguous groups;

vomerine patches separated by a distinct interval. (a)

Sphenoidal teeth in two not contiguous groups; vomerines often approximated. (d)

a. Color cinereous; dorsal band red, rarely wanting. (b)

a. Color black, dorsal band always wanting. (c)

b. Costal furrows 16 or more.

P. ERYTHRONOTUS. (1).

b. Costal furrows 14. . P. INTERMEDIUS. (5)

c. With irregular gray blotches, costal furrows 14. P. GLUTINOSUS. (2)

c. Color uniform black; costal furrows 12.

P. NIGER. (7)

d. Costal furrows 13 or less; muzzle truncate; vomerine groups of teeth medially approximated. (e)

d. Costal furrows 14 or more; muzzle round; vomerines few or none. (1)

e. Plantar tubercles two in front; spots minute. P. OREGONENSIS. (3)

e. Plantar tubercles none; spots large orange. P. CROCEATER. (4)

f. Dorsal band wanting; dots red or none; toes long; body marbled below.

P. FUSCUS. (6)

f. Dorsal band yellowish; dots brown; toes short; body dirty white below.

P. OCHROPHÆUS. (8)

1. **Plethodon erythronotus**, Green. (14)

THE RED-BACKED SALAMANDER.

Synonyms, *Salamandra erythronota*, Green, Storer, De Kay, Holbrook, Harlan; *Salamandra agilis*, Sager; *Plethodon cinereum*, Tschudi; *Amblystoma erythronotum*, Gray; *Saurophis*, Fitzinger; *Spelerpes erythronotus*, Kennicott.

Color upon the sides cinereous; *dorsal stripe* extending from the occiput to the extremity of the tail of *deep or light red*; head brown above; lower jaw and gular region whitish; ventral part of the body light, but not as much so as the throat and chin; sides in alcohol sometimes reddish brown, and dorsal stripe cream-colored; eyes large, black; head somewhat depressed, scarcely separable from the body; canthus rostralis none; costal grooves sixteen to nineteen; caudal furrows about twenty; cervical fold indistinct, its place represented by a white line; nostrils laterally situated.

Length $3\frac{1}{2}$ inches. Head to cervical fold 9-16 inch.

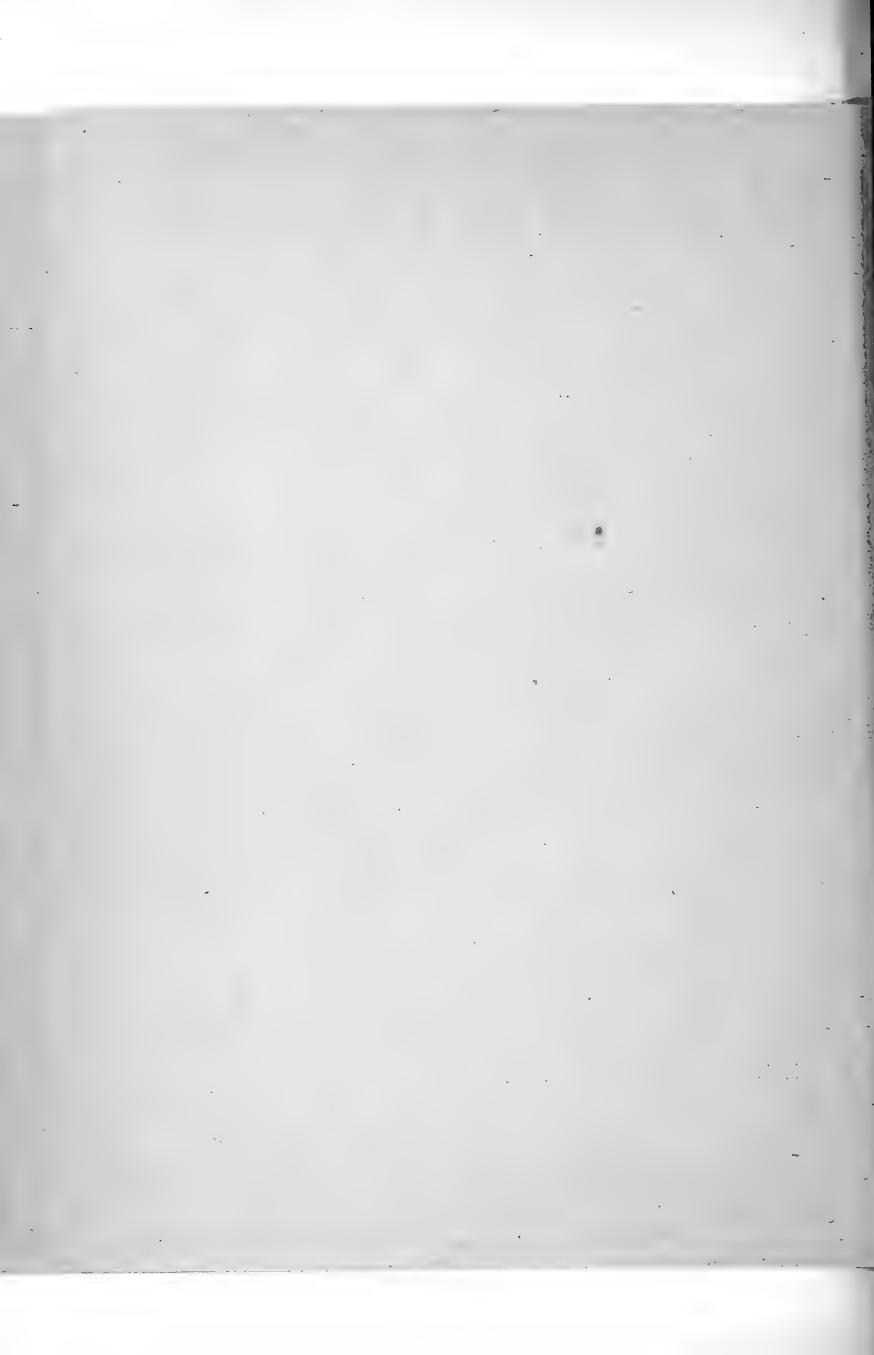
Tail $1\frac{3}{4}$ " Width of head 7-32 "

Habitat Northern Michigan, Kentucky, South Carolina, Massachusetts and Nova Scotia. Very common.

Haldeman (38) states that while Herpetologists have supposed that *P. erythronotus* and *cinereus* are different sexes of the same species from their having been so often found associated together, yet he as a result of care-

FUSCUS.	NIGER.	OCHROPHÆUS.	PERSIMILIS.
own.	Black.	Yellowish.	Black.
rbled.	Black.	Dirty White.	Plumbeous.
d.	None.	Brown.	Gray.
nute or None.	None.	Dots.	Irregular.
ne	None.	Yellow.	None.
und.	Round.	Round.	Truncate.
w or None.	Distant.	Few or None.	.....
parate.	Contiguous.	Distant.	.....
isthocœlous.	Ophisthocœlous.	Opisthocœlous.	.....
urteen & Fifteen.	Twelve.	Fourteen.	.....
ng and Free.	Long and Free.	Short and Free.	Free.
ne.	None.	None.	.....
inches.	6 inches.	3 inches.	.....
lines.	5 lines.	1-5 inch.	.....
S. east of the Miss.	U. S. east of the Miss.	Pennsylvania.	Siam.

PLETHODON.	ERYTHRONOTUS.	GLUTINOSUS.	OREGONENSIS.	CROCEATER.	INTERMEDIUS.	FUSCUS.	NIGER.	OCHROPHÆUS.	PERSIMILIS.
Color. { Above.	Cinereous.	Black.	Brown.	Black.	Cinereous.	Brown.	Black.	Yellowish.	Black.
Color. { Below.	Light Marbled.	Plumbeous.	Yellow.	Orange.	Light Marbled.	Marbled.	Black.	Dirty White.	Plumbeous.
Spots. { Color.	Ashy.	Gray.	Black.	Orange.	Ashy.	Red.	None.	Brown.	Gray.
Spots. { Shape.	Speckled.	Irregular.	Minute Dots.	Large.	Speckled.	Minute or None.	None.	Dots.	Irregular.
Dorsal Band.	Red.	None.	None.	None.	Red.	None.	None.	Yellow.	None.
Muzzle.	Truncate.	Truncate.	Truncate.	Truncate.	Truncate.	Round.	Round.	Round.	Truncate.
Teeth { Vomerines medially.	Distant.	Distant.	Approximated.	Approximated.	Distant.	Few or None.	Distant.	Few or None.	.....
Teeth { Sphenoidals.	Contiguous.	Contiguous.	Separate.	Separate.	Contiguous.	Separate.	Contiguous.	Distant.	.....
Vertebræ.	Amphicœlous.	Amphicœlous.	Amphicœlous.	Amphicœlous.	Amphicœlous.	Opisthocœlous.	Opisthocœlous.	Opisthocœlous.	.....
Costal Furrows.	Sixteen & Nineteen.	Fourteen.	Ten & Eleven.	Thirteen.	Fourteen.	Fourteen & Fifteen.	Twelve.	Fourteen.	.....
Digits.	Palmate.	Free.	Free.	Free.	Nearly free.	Long and Free.	Long and Free.	Short and Free.	Free.
Plantar Tubercles.	Indistinct.	None.	Two in front.	None.	Indistinct.	None.	None.	None.	.....
Length.	3½ inches.	4½ inches.	3 7-11 inches.	6 inches.	3.65 inches.	3½ inches.	6 inches.	3 inches.	.....
Width of Head.	7-32 inch.	¾ inch.	4 lines.	6¾ lines.	3 lines.	3¾ lines.	5 lines.	1-5 inch.	.....
Habitat.	U. S. east of the Miss.	U. S. east of the Miss.	Oregon.	Lower California.	Vancouver Is. to L. Cal.	U. S. east of the Miss.	U. S. east of the Miss.	Pennsylvania.	Siam.



ful examination came to the conclusion that they were not. Four *cinereus* opened by him contained gravid ovaries, and hence were females; on the other hand two *erythronotus* contained only seminal matter and spermatozoa imperfectly developed. Two others were found, however, with gravid ovaries; hence we have of the *erythronotus* both male and female. Prof Green, however, after careful revision concluded that the *cinereus* was probably only an aged individual in which the dorsal stripe had become obsolete.

The Red-backed Salamander is the first seen in spring, having been observed in the middle of April. It is found in moist woody places, hiding under stones and old logs, and when discovered if alone it quickly disappears in the decayed wood, moss or earth, but if accompanied by its young neither it nor the little ones attempt to escape. It climbs glass by adhering with its abdomen, is frequently curled up on herbs, and if disturbed springs away by a sudden uncoiling. Their food appears to be small snails or mollusks, and when the young are found as a rule they are accompanied by the parent, but are sometimes alone. Their little ones as well as their eggs occur under the moss and bark of decayed trees. The latter are found in bunches of from six to eleven each, and individually are about 3-20 of an inch in diameter. The young are supplied with branchiæ, but lose them very early—that is in about three or four days after hatching.

2. **Plethodon glutinosus**, Tschudi, (14)

THE GRAY SPOTTED SALAMANDER.

Synonyms, *Salamandra glutinosa*, Green, Schlegel, Harlan, Holbrook, Storer, De Kay; *Salamandra variolata*, Gilliams; *Salamandra cylindracea*, Harlan; *Plethodon variolosum*, Tschudi, Dumeril and Bibron; *Cylindrosoma glutinosum*, Dumeril and Bibron; *Triton porphyriticus* ? De Kay; *Plethodon granulatum*, Gray; *Salamandra elongata*, Valenciennes.

Color above black glossy, with numerous minute gray spots, upon the sides larger, in some almost confluent, in others licheniform patches; color below plumbeous, with small spots of gray in the gular region; legs also spotted; cervical fold and a narrow strip on each side of anus of a yellowish tinge; costal furrows fourteen; nares equidistant; vomerine series of teeth extending to the exterior of inner nares; canthus rostralis none; nostrils small, laterally situated; head and body scarcely or not at all separable; cervical or gular fold distinct; body with a dorsal longitudinal furrow; tail long, round, tapering; legs moderately long, slender and not very strong; head depressed; eyes not as prominent as in *P. erythronotus*.

Length $4\frac{1}{2}$ inches.

Tail 2 "

Head to cervical fold $\frac{1}{2}$ inch.

Breadth of head $\frac{3}{8}$ "

Habitat Massachusetts, Florida, Louisiana, Illinois, and the country included. Straits of Belle Isle? (2) Common.

This animal conceals itself under rocks and logs in moist places, but has been found upon dry elevated ground. The color seems to vary much with age, the young being much more thickly spotted than the adult. In the specimens before me this variation is not influenced by locality.

3. *Plethodon Oregonensis*, Girard.

Synonyms, *Heredia Oregonensis*, Girard; *Ensatina Eschscholtzii*, Gray; *Plethodon ensatus*, Cope.

Color brown above, but under a lens appears as minute black dots upon an olive ground; sides similarly spotted; below yellow; head broader than body; muzzle truncate; nostrils small, widely separated; eyes prominent; cervical fold well marked; vomerine teeth in two series, one on each side, almost uniting in front in a reversed V form; tongue attached in front; parotids none; plantar tubercles two in front, none behind; costal furrows ten or eleven; tail cylindrical, tapering; limbs slender; anterior ones longest; toes tapering, slender and free.

Length 3 7-12 inches. Head to cervical fold 5 lines.

Tail 1 7-12 " Breadth of head 4 "

Habitat Oregon, California ?

4. **Plethodon croceater**, Cope.

Color above black, below reddish orange; parotid region with a very large reddish orange spot; four similar spots present on each side of the back; base of tail with a pair of spots; limbs orange, with a transverse band of black below the knee; head broad; maxillaries converging; muzzle truncate; vomerine series of teeth in two arcs; eye large; postorbital, and parotid grooves distinct; costal furrows thirteen, not well marked; tail slender, subcylindrical, exceeding the length of the body; limbs long and slender.

Length 6 inches.

Head to cervical fold 5 lines.

Tail $3\frac{1}{4}$ "

Breadth of head $6\frac{3}{4}$ "

Habitat Lower California.

5. **Plethodon intermedius**, Baird.

This species is very clearly related to *P. erythronotus*, from which it is separated by having fourteen instead of sixteen to nineteen costal furrows, thus shortening the main part of the body. The feet are scarcely at all palmate, and the third and fourth toes much longer. Its

habitat also is quite different, but on the whole I am disposed to consider it a variety of that species.

Habitat Vancouver's Island and Lower California.

6. *Plethodon fuscus*.

Synonyms, *Salamandra picta*, Harlan, Storer, De Kay; *Salamandra intermixta*, Green; *Salamandra quadramatulata*, Holbrook; *Triturus fuscus*, Rafinesque; *Desmognathus fusca*, Baird, Cope; *Salamandra auriculata*, Hallowell, Gray, Baird; *Cylindrosoma auriculatum*, Dumeril and Bibron; *Salamandra Haldemani* ? Holbrook; *Spelerpes Haldemani* ? Hallowell.

Color brown marbled with pink; vertebral region not so dark; laterally and ventrally still lighter, sometimes yellowish or very light orange, but generally brown and white marbled; chin and gular region almost white; head very much depressed; muzzle round, not truncate; parasphenoidal teeth not contiguous; vomerines few in a row on each side, often wanting; eyes prominent; dorsal longitudinal furrow present; cervical fold, postorbital and parotid grooves well marked; costal furrows 13 to 15, usually 14; limbs small; toes long and slender; vertebræ opisthocœlous; tail compressed, carinate above, sometimes terminating in a fin, but usually pointed.

Length $3\frac{1}{2}$ inches. Head to cervical fold $\frac{1}{2}$ inch.

Tail $1\frac{3}{8}$ " Breadth of head 5-16 "

Habitat New York to Georgia, Alabama and Ohio.
Common.

Var. *auriculatus* differs from this by being black or nearly so above, with a reddish spot behind and below the eye, and minutely punctate with red upon the sides.

Lives in shallow brooks, and emits its eggs in a string connected by albuminous matter, which is afterwards wound around the body by one of the pair.

7. *Plethodon niger*, Hallowell.

Synonyms, *Desmognathus nigra*, Baird, Cope, Gray; *Triton niger*, Holbrook; *Salamandra nigra*, Green, Harlan.

Color dark brown or black, lighter beneath; head large, depressed, not separable from the body; muzzle rounded; sphenoidal teeth in two groups, almost or quite united anteriorly; vomerine series approximated in two oblique rows; tongue round; body large; limbs appressed; toes very long, distinct; gular fold well marked; parotid and postorbital grooves scarcely visible; eyes prominent; costal furrows twelve; tail subcylindrical at base, becoming compressed, tapering to the tip, and usually provided with a fin.

Length 6 inches.

Tail 2 4-5 inches.

Habitat Massachusetts to Georgia and Louisiana.

Inhabits shallow springs in cool moist places, and con-

ceals itself under stones; quick in its movements and difficult to capture. Seems to be highly endowed with vitality, and its metamorphosis is effected early, specimens one and one-half inches long being without branchiæ, and the females have been found from April 28th to June 26th with as many as seventy eggs in the ovaries. The eggs are yellow, not seen in the oviduct, and the number in the two ovaries was not equal.

8. **Plethodon ochrophæus**, Cope.

Synonym, *Desmognathus ochrophæa*, Cope,

Color brownish yellow, shading into a dirty white below, with a dark brown vertebral band; brown dots present in dorsal region; males somewhat darker; head depressed, oval; sphenoidal teeth well separated, vomerines few and often wanting; mandible in males concave in front of the eye, and toothless, but dentigerous in females; eyes prominent; cervical fold distinct; costal furrows thirteen, well marked; limbs appressed; toes free and short; tail very long, compressed, sometimes carinate, but never provided with a fin.

Length	3 inches.	Head to gular fold	$\frac{1}{2}$ inch
Tail	1 $\frac{1}{2}$ "	Breadth of head	1-5 "

Habitat Alleghany Region of Pennsylvania.

Dwells in damp woods under rocks, bark, wood, etc.

A variety of *P. fuscus* ?

9. *Plethodon persimilis*, Gray.

Mivart claims this is not a *Plethodon*, and designates it as *Pectoglossa*, but not having a specimen or a good description I am unable to satisfy myself of its true relation, and hence permit it to remain here.

Color black, speckled with white; laterally the specks are closer and more numerous; hind toes elongate, unequal; tail compressed.

Habitat Siam.

Dr. Gray states that the only difference he is able to discover between two specimens of this species received from Siam and *Plethodon glutinosus* from the United States is that "the toes of the hind foot appeared rather longer, more slender, and unequal in length, and the tail much more compressed."

6. *Geotriton*, Gene.

Oedipus, Gray.

Vomerine teeth in a transverse row behind the inner nares, medially forming a sharp angle pointed back-

wards; sphenoidals in two elongated groups, not touching the vomerines; tongue boletoid; eyes prominent; parotids wanting; toes palmate, four in front and five behind.

Some writers designate the first species as *Geotriton*, and the remainder as *Oedipus*, because in *fuscus* the two præmaxillaries are distinct, and are united in the others; but this is a characteristic difficult to determine, and probably the result of an immature condition. Until, then, further researches establish the fact, one is not warranted in making separate genera.

Back black or brown; no dorsal band. (a)

Back yellow, or with yellow dorsal band. (d)

a. Costal furrows ten or eleven. (b)

a. Costal furrows twelve or thirteen. (c)

b. Toes with two free phalanges.

G. FUSCUS. (1)

b. Toes completely palmate. G. RUFESCENS. (4)

c. Body below and limbs dotted with white.

G. MORIO. (2)

c. Body and limbs uniform dark brown.

G. ALTAMAZONICUS. (6)

d. Body moderately elongated.

G. CARBONARIUS. (3)

d. Body short and thick. G. ADSPERSUS. (5)

1. **Geotriton fuscus**, Gesner. (12, b)

Synonyms, *Salamandra fusca*, Gesner, Aldrovandi, Laurenti; *Salamandra savii*, Gosse; *Salamandra Genei*, Schlegel; *Geotriton Genei*, Tschudi.

Color brown above, with reddish lines scarcely perceptible; beneath spotted with white; head white; sphenoidal and vomerine teeth separated by a large interval; costal furrows ten; digits depressed, with two free phalanges.

Habitat Southern Italy.

2. **Geotriton morio**, Cope.

Synonyms, *Oedipus morio*, Cope; *Geotriton carbonarius*, (black variety) Cope.

Color black above, dark plumbeous below; whitish dots numerous over the limbs and lower parts of the body; head flat; muzzle truncate; sphenoidal and vomerine teeth nearly contiguous; costal furrows thirteen, distinct; limbs appressed; toes, except the inner, with

one free phalanx; tail cylindrical, tapering, annulate laterally.

Length 3.29 inches. Head to axilla .63 inches.

Tail 1.35 " Breadth of head .28 "

Habitat High Lands of Guatemala.

3. *Geotriton carbonarius*, Cope.

Synonyms, *Oedipus carbonarius*, Cope; *Bolitoglossa Mexicana*, (Pars) Dumeril and Bibron; *Salamandra platydactyla* ? Cuvier; *Oedipus platydactylus* ? Tschudi; *Oedipus Salvinii* ? Gray.

Color above yellow, from muzzle to tip of tail with black spots, and laterally changing abruptly to black, which color continues over the whole under surface; limbs spotted with yellow; the yellow upon the back might in some cases be regarded as a dorsal band; muzzle truncate; sphenoidal teeth contiguous, and continued towards the vomerines, but not touching them; costal furrows twelve or thirteen; toes broadly palmate; tail cylindrical, tapering, annulate for two-thirds its length. Length $6\frac{1}{4}$ inches.

Tail $3\frac{1}{4}$ "

Habitat elevated regions of Eastern Mexico.

4. **Geotriton rufescens**, Cope.

Synonym, *Oedipus rufescens*, Cope.

Color above black, below brown, with white specks; head above somewhat rufous; muzzle truncate; teeth not prolonged outwardly beyond the inner nares; sphenoidals nearly contiguous, and somewhat prolonged to the front; costal furrows ten or eleven; limbs appressed; toes completely palmate; tail cylindrical, thickened, shorter than body.

Length to groin 1.04 inches.

“ “ axilla .39 “

Habitat Vera Cruz.

5. **Geotriton adpersus**, Peters.

Synonyms, *Oedipus adpersus*, Cope; *Spelerpes adpersus*, Peters.

Color above black or dark brown, paler beneath, sprinkled above and below with white or yellow in the form of dots or small lines; dorsal band present, often sprinkled with black; head short, a little longer than

broad; muzzle obtuse; sphenoidal teeth in two groups contiguous in front and diverging behind; gular fold very distinct; body short and thick, with well marked costal furrows; skin otherwise smooth; thumb and first toe rudimentary; limbs short, anterior reaching almost to the eye, posterior scarcely longer; tail very short.

Length 3.1 inches.

Breadth of head 3.3 lines.

Tail 1.5 "

Habitat Bogota.

A variety of *G. carbonarius* ?

By an examination of an impregnated female, Peters (15, c) discovered developed eggs of nearly $1\frac{1}{2}$ lines in diameter, and thence concluded that a copulation had taken place, and that they were viviparous.

6. *Geotriton altamazonicus*, Cope.

Synonyms, *Oedipus altamazonicus*, Cope.

Color uniform dark brown; head elongate, oval; width less than one-sixth the length to groin; muzzle tumid emarginate; nostrils small, piercing each tumidity; vomerine teeth in contact medially, and outwardly limited by the inner nares; sphenoidals numerous in two patches, contiguous in front; costal furrows thirteen; dorsal longitudinal groove present; body slender; limbs weak, thin, and as well as the appressed feet, extending

over four costal furrows; mucous pores numerous; tail oval, swollen at base.

Length 3.23 inches. Breadth of head .28 inches.

Tail 1.57 "

Habitat Nauta.

7. **Batrachoseps**, Bonaparte.

Vomerine teeth in a transverse, medially interrupted, row behind the inner nares; sphenoidals in two elongated groups, not touching the former; tongue boletoid or adherent towards the front; præmaxillaries united into a single piece; head short; body and tail slender; toes elongated, four in front and four behind.

Color above brown or yellowish, with black dots, lines or bands. (a)

Color above uniform brown. (b)

- a. Tongue attached in front. B. ATTENUATUS. (1)
- a. Tongue fully boletoid. B. QUADRIDIGITATUS. (4)
- b. Toes palmate B. PACIFICUS. (3)
- b. Toes free and rudimentary. B. NIGRIVENTRIS. (2)

1. **Batrachoseps attenuatus**, Eschscholtz.

Synonym, *Salamandra attenuata*, Eschscholtz.

Color above reddish brown with a black vertebral line and transverse diagonal bands; *beneath brown*; costal furrows *twenty* or *twenty-one*; limbs weak, hind one extending over *four* costal spaces, fore one not reaching to the gape of mouth; feet small and thin; toes *free*; tail longer than the body.

Length 3 7-12 inches.

Tail 2 1-12 "

Habitat San Francisco.

2. **Batrachoseps nigriventris**, Cope.

Color above dark brown; tail and *under surface black*; muzzle short; gular fold marked; parotid groove present; costal furrows twenty or twenty-one, extending upon the back; body somewhat compressed; limbs weak; hind ones extending over *six* costal spaces; fore limb almost reaching to the orbit; toes rudimentary, *distinct*;

tail stout at base, nearly quadrate, strongly annulate, and compressed distally.

Length 22 lines.

Head to axilla $3\frac{1}{2}$ lines.

Tail $8\frac{1}{2}$ “

Breadth of head 1.7 “

Habitat Fort Tejon, California.

3. *Batrachoseps Pacificus*, Cope.

Synonym, *Hemidactylum Pacificum*, Cope.

Color *uniform brown, yellowish beneath*; head oval; elongate; muzzle round; eyes large, prominent; tongue eccentric oval; sphenoidal and vomerine teeth almost in contact; gular fold not marked, but represented by a line; costal furrows *eighteen*; fore limb extending to orbit, hind one reaching over *seven and a half* costal spaces; toes *palmate*, inner quite rudimentary; tail slender, nearly cylindrical.

Length $33\frac{1}{2}$ lines.

Tail 17 “

Habitat Santa Barbara, California.

4. **Batrachoseps quadridigitatus**, Holbrook.

Synonyms, *Manculus quadridigitatus*, Cope; *Salamandra quadridigitata*, Holbrook.

Color dirty yellow, with minute dark brown spots or dorsal lines and irregular lateral spots of a similar shade; abdomen bluish silvery white; head large; tongue fully boletoid, never adherent towards the front; limbs moderate; toes distinct; tail very long.

Length $3\frac{1}{3}$ inches.

Habitat South-eastern Georgia.

Found under decaying wood, comes out during wet days and after dusk.

Insectivorous.

8. **Spelerpes**, Rafinesque.

Synonyms, *Cylindrosoma*, Tschudi; *Cylindrosoma* et *Bolitoglossa*, in part Dumeril and Bibron; *Spelerpes* and *Pseudotriton*, Baird, Hallowell; *Spelerpes Ophiobatrachus*, *Gyrinophilus*, *Stereochilus*, and *Thorius*, Cope.

Vomerine teeth in a transverse row behind the inner nares, interrupted medially; *sphenoidals* in two elongated

groups, separated from each other, usually narrower in front, and diverging behind; *tongue boletoid*; head short depressed; body cylindrical, slender; digits free, four in front, five behind; tail long, tapering, and distally compressed.

Body with distinct spots or bands. (a)

Body spotless, or with minute dots. (h)

a. Costal furrows 15-17. (b)

a. Costal furrows 14 or less. (c)

b. Color in the main red. *S. RUBER*. (4)

b. Color cinereous and white with black,

S. MARGINATUS. (11)

c. Inner toes rudimentary. (d)

c. Inner toes not rudimentary. (e)

d. Spots yellow, licheniform.

S. LEPROSUS. (7)

d. Spots red, in two dorsal pyriform series.

S. BELLII. (8)

e. Color above yellow. (f)

e. Color above cinereous, lines black.

S. BILINEATUS. (1)

e. Color above brown. (g)

f. With dark spots; no vertebral line. . . . *S. LONGICAUDUS*. (2)

f. With black vertebral line.

S. GUTTOLINEATUS. (3)

g. Costal furrows 14, white below. *S. PORPHYRITICUS*. (10)

g. Costal furrows 13, yellowish clouded below.

S. PENNATULUS. (12)

h. Costal furrows 21.....S. MULTIPLICATUS. (9)



limbs slender; digits long, excepting the first and last;
tail nearly as long as the body, sometimes longer.



	SPELERPES.	BILINEATUS.	LONGICAUDATUS.	GUTTOLINEATUS.	RUBER.	CHIROPTERUS.	CEPHALICUS.	LEPROSUS.	BELLII.	MULTIPLICATUS.	PORPHYRITICUS.	MARGINATUS.	PENNATULUS.	LINEOLUS.	VERMICULARIS.
Color.	{ Above Below	Cinereous. Yellowish.	Yellow. Lighter.	Yellowish. Mottled.	Red. Paler.	Brownish Black. Impure White.	Brownish. Impure White.	Black. Brown.	Black. Paler.	Brown. Lighter.	Pale Brown. White.	Cinereous. White.	Brown. Yellowish cloud- ed.	Black. Paler.	..... .....
Spots.	{ Color Shape	Black. Dorso-lateral Lines.	Black. Spots and Bars.	Black. Lines and Bars.	Black. Circular.	None. None.	None. None.	Yellow. Licheniform.	Red. Pyriform in two series.	None. None.	Gray. Irregular.	Black. Dots and Lines.	Gray. Band with "V" form spots.	None. None.	Black. Minute.
Vomerine & Sphenoid Teeth.	Separate.	Separate.	Separate.	Separate.	Contiguous.	Separate.	Separate.	Separate.	Separate.	Separate.	Separate.	Contiguous.	Separate.	Separate.	Separate.
Costal Furrows.	Fourteen.	Thirteen.	Thirteen.	Thirteen.	Fifteen & Sixteen.	Eleven & Twelve	Eleven & Twelve	Twelve.	Twelve.	Twenty-one.	Fourteen.	Seventeen.	Thirteen.	Fourteen.	Nineteen.
Inner Toes.	Developed.	Developed.	Developed.	Developed.	Developed.	Rudimentary.	Rudimentary.	Rudimentary.	Rudimentary.	Small.	Developed.	Developed.	Short.	Rudimentary.	Short.
Tail at Base.	Almost Tetragonal.	Subround.	Subround.	Subround.	Round.	Round.	Round.	Round.	Round.	Round.	Round.	Compressed.	Subquadrate.	Constricted.	.....
Length.	2¾ inches.	5 inches.	7 inches.	7 inches.	5 inches.	3 inches.	3 inches.	3½ inches.	8 inches.	3¼ inches.	5.7 inches.	2 11-12 inches.	2 inches.	2¾ inches.	6¾ inches.
Breadth of Head.	2¼ lines.	¼ inch.	.....	.....	6 lines.	3 lines.	3 lines.	.3 inch.	6 lines.	.22 inch.	.....	2 lines.	1 8-5 lines.	.....	.....
Habitat.	U.S. east of the Miss.	U. S. east of the Miss.	S. Carolina to Alabama	S. Carolina to Alabama	U.S. east of Rocky Mts	Mexico.	Mexico.	Mexico.	Mexico.	Arkansas.	Alleghany Mts.	Georgia.	Mexico	Mexico.	Mexico.

groups, separated from each other, usually narrower in front and diverging behind.

- h. Costal furrows 21.....S. MULTIPLICATUS. (9)
- h. Costal furrows 19.....S. VERMICULARIS. (14)
- h. Costal furrows 14.....S. LINEOLUS. (13)
- h. Costal furrows 11-12.
 - i. Vomerine teeth prolonged outwardly beyond nares.....S. CEPHALICUS. (6)
 - i. Vomerine teeth not prolonged outwardly beyond nares.....S. CHIROPTERUS. (5)

1 **Spelerpes bilineatus**, Green. (14)

STRIPED-BACK SALAMANDER.

Synonyms, *Salamandra bilineata*, Green, Holbrook, Harlan, Cuvier, De Kay; *Salamandra flavissima*, Harlan, Holbrook; *Salamandra cirrigera*, Green, Harlan; *Spelerpes cirrigera*, Baird, Gray, Hallowell; *Bolitoglossa bilineata*, Dumeril and Bibron.

Color above cinereous, with two or three longitudinal black lines; vertebral line narrow, but broader in front, sometimes nearly or quite effaced; below yellow or yellowish white; color very much obscured by alcohol; head oval, eyes ovate; iris yellow; postorbital and parotid folds distinct, gular only marked by a cicatrice; costal grooves fourteen, in most specimens indistinct; limbs slender; digits long, excepting the first and last; tail nearly as long as the body, sometimes longer.

Length $2\frac{3}{4}$ inches. Head to gular fold $\frac{3}{8}$ inch.
 Tail $1\frac{1}{4}$ " Breadth of head 3-16 "

Habitat Maine to Florida, Louisiana, and Wisconsin.
 Common.

Lives under stones and decaying matter in woods and moist places, especially along the banks of brooks and in shallow water, and is very active.

Var. *cirrigera* seems to differ from this mainly in the possession of two barbels between the nostrils and lip in the male; they are not present in the female. Green (9, b) says, "when these animals were alive the cirrhi or nasal appendages were about one-fourth of an inch long. From the situation where they were found, and from their general appearance, they must be placed among the Land Salamanders; but their fleshy cirrhi seems conclusively to prove that their principal resort must be in the water."

2. *Spelerpes longicaudus*, Green. (14)

THE LONG-TAILED SALAMANDER.

Synonyms, *Salamandra longicauda*, Green, Holbrook, De Kay, Harlan; *Spelerpes lucifuga*, Rafinesque; *Cylindrosoma longicaudatum*, Tschudi, Dumeril and Bibron; *Saurocercus longicauda*, Fitzinger.

Color yellow; body, head, chin, and gular region cream-colored, belly yellowish white; spots dark color-

ed, numerous, and irregular in form, scattered thickly over the upper and lateral surface; below immaculate; head nearly oval, more depressed than in the preceding species; vomerine teeth and sphenoidal groups not contiguous; eyes elongated, not very prominent; nostrils lateral and minute; postorbital fold invisible, parotid well marked, but the place of the gular represented by a scar; limbs slender; digits moderate, widely separated; tail very long, nearly equaling and sometimes exceeding twice the length of the body; back without a longitudinal groove, but with the spots here and upon the sides arranged somewhat in rows.

Length 5 inches.

Head to gular fold $\frac{5}{8}$ inch.

Tail 3 1-5 "

Breadth of head $\frac{1}{4}$ "

Habitat Maine to Florida, Louisiana and Wisconsin.

Frequents running water in deep caverns, and thus resembles the *Proteus* of Carniola. Its subterranean habits prepare us to expect what we actually find it to be, one of our most beautiful specimens of Salamander.

Spelerpes guttolineatus, Holbrook.

Salamandra guttolineata, Holbrook, De Kay; *Cylindrosoma guttolineatum*, Dumeril and Bibron.

Color above pale yellowish, with a black vertebral line which bifurcates upon the nape in order to allow its two branches to terminate interior to the eyes; a lateral band of black containing small square spots and edged

with a white line below; body beneath white, dark gray, or mottled; tail black, barred with yellow, carinate above, longer than the body, and sometimes equaling twice the distance from muzzle to posterior of anus; head short, in size equal to the trunk; sphenoidal and vomerine teeth not contiguous; costal furrows thirteen; inner toes longest.

Length 7 inches.

Habitat Mountains of South Carolina, Georgia, and Alabama

Spelerpes ruber, Daudin.

THE RED SALAMANDER.

Synonyms, *Salamandra rubra*, Daudin, Holbrook, De Kay; *Salamandra maculata*, Green, Storer, Harlan; *Salamandra rubriventris*, Green; *Salamandra subfusca*, Green; *Salamandra fusca*, Harlan; *Pseudotriton subfuscus*, Tschudi; *Mycetoglossa ruber*, Bibron; *Mycetoglossus subfuscus*, Bonaparte; *Siren operculata*, Palissot Beauvois; *Proteus neo Cæsariensis*, Green; *Pseudotriton ruber*, Baird; *Pseudotriton sticticeps*, Baird; *Pseudotriton montanus*, Baird; *Pseudotriton flavissimus*, Hallowell.

Color above red with numerous nearly circular small black spots; beneath less vivid and immaculate, except in the gular region; in alcohol the color is dark yellow-

ish or light brownish, and the spots brown; head in perpendicular longitudinal section nearly a perfect triangle, in width equal to the body and not separable from it; muzzle round; *sphenoidal and vomerine teeth contiguous* at the anterior margin of the former, the latter continuing outwardly to posterior of inner nares; eyes prominent; nostrils minute; postorbital and parotid grooves indistinct; gular fold strongly marked; costal furrows fourteen to sixteen; tail and anal region with numerous circular folds indistinct above and disappearing distally; a longitudinal groove runs from the anus towards the extremity of the tail; skin upon the back forming a longitudinal ridge from the nape backwards; limbs moderate, hind ones much the stronger; inner toes longest; tail round at the base, but compressed distally.

Length	5 inches.	Head to gular fold	$\frac{5}{8}$ inch.
Tail	$1\frac{1}{4}$ "	Breadth of head	$\frac{1}{2}$ "

Habitat United States east of the Rocky Mountains.
Common.

The Red Salamander is found under stones in shallow water and marshes. When discovered in the former they seem to be alarmed, and endeavor to get away, but in the latter situation show no disposition to stir. They are apparently nocturnal animals, remaining in concealment during the day, and at night sallying forth in search of prey. Their food is mainly small worms, though Hallowell found in the stomach of one a coleopterous insect, and the tail and posterior limbs of a Salamander, probably *Plethodon niger*, and they are themselves devoured by the American Bittern, and doubtless many other animals in like manner prey upon them. In con-

finement they rarely leave the water in the daytime, but usually do so at night.

Green's description (9, c) of *Proteus neo Cæsariensis* gives the characteristics of the young, and is as follows: "Cauda mediocri et compressa forma pinnæ, corpore albido.

Length between four and five inches; tail as long as the body, tapering and forming a fin; tongue short, round, adhering to the lower jaw and having a cartilaginous edge; branchiæ persistent; eyes very small; nostrils invisible; back dirty white, with small dots, margined with a narrow red line, commencing at the fore shoulder and terminating at the posterior legs, beneath whitish; posterior feet five-toed, anterior four-toed."

5 *Spelerpes chiropterus*, Cope.

Synonym, *Spelerpes orculus*, Cope.

Color above brown or black, paler along the vertebral line, but not forming a longitudinal band; beneath dirty white; head oval; muzzle truncate; vomerine teeth forming an arch not contiguous with the sphenoidal groups; gular fold distinct; costal furrows eleven or twelve; limbs moderate; digits short, depressed, free, inner represented only by a wing-like rudiment; tail compressed, flat above, sometimes cylindrical at base, but

apering rapidly, one-fifth longer than the distance from muzzle to posterior of anus.

Lenth 3 inches. Head to gular fold 3 4-5 lines.

Tail 1.9 " Breadth of head 3 "

Habitat Mexico.

Spelerpes cephalicus, Cope.

Very much resembles the preceding, of which it is probably a variety; without seeing a specimen, the only points of difference seem to be the prolongation in this of the vomerine teeth outwardly beyond the inner nares, the short and stouter form, and the marbling of the gular region.

Habitat Table Lands, Mexico.

7. **Spelerpes leprosus**, Cope.

Color black above, brown below; sides and gular region licheniform, spotted, with pale yellow which changes to gray in alcohol; head broad; muzzle short truncate; vomerine series prolonged externally beyond the inner nares, touching medially, but not contiguous

with the sphenoidal groups; postorbital and parotid gooves indistinct; gular fold well marked; costal furrows twelve; limbs moderate; digits short, but longer than in *chiropterus*, round, and terminating in swollen extremities; tail cylindrical and tapering.

Length $3\frac{1}{2}$ inches. Head to gular fold 4-5 inch.

Tail $1\frac{1}{2}$ " Breadth of head 3 "

Habitat Elevated Regions of Eastern Mexico.

8 *Spelerpes bellii*, Gray. (12, b)

Synonyms, *Oedipus platydactylus*, Tschudi, Baird; *Bolitoglossa Mexicana*, Dumeril and Bibron; *Salamandra guttata*, Wiegman.

Color black, with *two dorsal series of pyriform red spots*; in alcohol changes to plumbeous with white spots; the two series of spots unite into *one nodulous row* above the anterior limbs, but bifurcate upon the nape and swell into two large blotches in the parotid region; below immaculate; head short and broad; muzzle rounded; vomerine teeth prolonged externally beyond the inner nares, and not contiguous with the sphenoidal groups; body large and strong; limbs stout; digits broad, short, depressed, free or *very* nearly so, never palmate as represented in Dumeril and Bibron's plate; extremities of toes with small round pellets; gular and postorbital folds prominent; costal furrows twelve or thirteen, strongly

marked, as are also the caudal annuli; tail cylindrical and swollen at the base.

Length 8 inches.

Head to gular fold $\frac{2}{3}$ inch.

Tail $4\frac{3}{4}$ "

Breadth of head $\frac{1}{2}$ "

Habitat Eastern Mexico.

9. *Spelerpes multiplicatus*, Cope.

Color uniform brown, below a lighter brown, especially around the throat and chin; sides rarely of a pinkish hue, and sometimes the belly and gular region are pale yellow; head much depressed; muzzle truncate; vomerine teeth in two short series, not touching medially, and well separated from the sphenoidal groups; toes short, inner minute; *costal furrows twenty-one*; tail round at base, distally compressed, and carinate.

Length $3\frac{1}{4}$ inches.

Breadth of head .22 inch.

Habitat Red River, Arkansas.

10. *Spelerpes Porphyriticus*. Green.(14)

SALMON-COLORED SALAMANDER.

Synonyms, *Salamandra porphyritica*, Green, Holbrook; *Salamandra salmonea*, Storer, Holbrook, De

Kay; *Pseudotriton salmoneus*, Baird, Hallowell, Allen; *Spelerpes salmoneus*, Gray, Cope; *Gyrinophilus porphyriticus*, Cope; *Amblystoma salmoneum*, Dumeril and Bibron.

Color yellowish brown above; sides salmon color, with a tinge of yellowish; upper surface irregularly marked with gray, below white; tail yellowish, head large, flattened; muzzle truncate; eyes prominent, and distant from each other; inner nares large; nostrils small; gular fold strongly marked; canthus rostralis prominent; dorsal longitudinal groove present; costal furrows usually fourteen; limbs moderate; digits entirely distinct; tail compressed and carinate.

Length 5.7 inches.

Tail 2.3 "

Habitat Alleghany Mountains from Vermont to Alabama. Common.

Found on moist land and in still water. It attempts self-defense, snaps savagely, and throws its body into contortions when disturbed. In confinement it appeared healthy for a year, and lived upon flies.

11. *Spelerpes marginatus*, Hallowell.

Synonyms, *Pseudotriton marginatus*, Hallowell; *Stenochilus marginatus*, Cope.

Color above dark cinereous, dimly shaded with yellowish; sides with a band of dusky white, edged with

black, extending from limb to limb; beneath white, with minute black spots or blotches; head small, depressed; muzzle round; eyes lateral, not prominent; inner nares small; sphenoidal teeth in several rows, contiguous with the vomerines; tongue small, boletoid; præmaxillary bones united; fontanelle none; gular fold distinct; costal furrows seventeen; tail compressed from base.

Length 2 11-12 inches. Head to gular fold $\frac{1}{3}$ inch.

Tail $1\frac{1}{3}$ " Breadth of head $\frac{1}{6}$ "

Habitat South-eastern Georgia.

12. *Spelerpes pennatulus*, Cope.

Synonym, *Thorius pennatulus*, Cope.

Color brown above with a gray dorsal band, below yellow and clouded; margins of dorsal band serrate with V form divergent spots; head neither depressed nor separable from the body; muzzle quite prominent; sphenoidal teeth in two pyriform groups, narrowest in front; vomerines consisting of four or five teeth on each side; postorbital grooves and gular fold not prominent; costal furrows slightly marked below, invisible above; limbs moderate; digits short and separate, or slightly palmate at base; tail subquadrate near the anus, not carinate, but compressed distally.

Length 2 inches.

Head to axilla 3 3-5 lines.

Tail 1 "

Breadth of head 1 3-5 "

Habitat Orizava, Mexico.

Spelerpes lineolus, Cope.

Synonym, *Opheobatrachus lineolus*, Cope.

Color above black, sides paler; chin and gular region cinereous; muzzle truncate; vomerine teeth in a long series; gular fold distinct; costal furrows fourteen; anterior limbs weak, posterior stout; toes flat, inner rudimentary; skin finely wrinkled; tail constricted at base.

Length $2\frac{2}{3}$ inches.

Head to axilla 6 4-5 lines.

Tail $1\frac{2}{3}$ “

Habitat Table Lands of Eastern Mexico.

Spelerpes vermicularis, Gray.

Synonyms, *Ophiobatrachus vermicularis*, Gray, Cope; *Oedipina uniformis*, Keferstein.

Body very much elongated, vermiform, hence the name; head small; muzzle obtuse, ovate; costal furrows nineteen; skin smooth, closely and minutely punctate with black; teeth minute; vomerines in an arched row; sphenoidals not contiguous with each other; skull mem.

branous above; parietals distinct, scale-like; limbs long, slender, weak, and distant from each other; toes short. Length $6\frac{3}{8}$ inches.

Tail $4\frac{1}{4}$ “

Habitat Costa Rica.

9. **Hynobius**, Tschudi.

Synonyms, Hynobius and Pseudo-Salamandra, Tschudi; Hynobius and Molge, Gray; Ellipsoglossa, Dumeril and Bibron, Hallowell.

Vomerine and palatine bones not dentigerous; sphenoidal teeth in two rows, one on each side of the median line, divergent in front and approximated behind, thus resembling a V; tongue oval, entire, free only upon its sides; toes four in front, five behind; tail much compressed. Species both aquatic.

This genus is especially characterized by the arrangement of the teeth, it being the only one in which the *sphenoidal* teeth are *widely* divergent in front, and also by having the tongue attached anteriorly and posteriorly, and hence not protrusible.

Body short and thick; color yellowish brown.

H. NEBULOSUS. (1)

Body very much elongated; color bluish or slaty gray.

H. NÆVIUS. (2)

1. **Hynobius nebulosus**, Schlegel.

Synonyms, *Salamandra nebulosa*, Schlegel; *Ellipsoglossa nebulosa*, Dumeril and Bibron, Hallowell.

Color yellowish brown, more or less darkened with very fine marblings; usually a yellow caudal stripe above and below; trunk short and thick; truncal vertebræ seventeen; head not separable from the body; gular fold not very prominent.

Length 4 inches.

Tail 2 “

Habitat Japan.

Head to axilla 1 inch.

Breadth of head .47 “

2. **Hynobius nævius**, Schlegel. (12)

Synonyms, *Salamandra nævia*, Schlegel; *Pseudo-Salamandra nævia*, Tschudi; *Molge nævia*, Bonaparte; *Molge striata*, Merrem, Gray; *Ellipsoglossa nævia* Dumeril and Bibron, Hallowell.

Color bluish to slaty gray, with small lighter spots; sides marbled; skin smooth; body elongated; trunca, vertebræ eighteen; head scarcely separable from the

body; eyes very prominent; postorbital and gular fold strongly marked; parotid mass distinct; dorsal longitudinal groove present.

Length 5.12 inches.

Head to axilla 1.1 inches.

Tail 2 " "

Breadth of head .4 " "

Habitat Japan.

10. **Salamandra**, Wurfbaïn, Laurenti.

Teeth in two longitudinal rows upon the palatine bones overlapping the sphenoid; transverse or vomerine series none; tongue free only at its sides, and partially so behind; parotids very prominent; body stout; ribs rudimentary; head large, depressed; skin usually rough; a series of mucous pores present on each side; limbs strong; toes large, distinct, four in front and five behind.

Spots large yellow. (a)

Spots none S. ATRA. (3)

a. Palatine teeth in arches S. MACULOSA. (1)

a. Palatine teeth parallel S. CORSICA. (2)

1. **Salamandra maculosa**, Laurenti.

Synonyms, *Salamandra maculata*, Merrem; *Salamandra vulgaris*, Cloquet; *Salamandra terrestris*, Lacepede and others.

Color black, with large yellow blotches arranged over the upper and lateral surfaces; head ovate; muzzle forming an obtuse angle; nostrils directed forward; eyes not very prominent; parotids exceedingly large; postorbital and parotid grooves distinct; gular fold strongly marked; costal furrows eleven; dorsal longitudinal groove barely visible; tail annulate, especially in the anal region, carinate below, and compressed from the base.

Length 6 inches. Head to gular fold 7-8 inch.

Tail $2\frac{1}{4}$ " Breadth of head $\frac{3}{4}$ "

Habitat Europe.

In the daytime lives under stones, old walls, etc., but comes out during rain, and at night to seek its prey, which consists of flies, beetles, young snails, worms and the like. Reproduction ovoviviparous.

Dumeril and Bibron (12) distinguish three varieties according to the disposition of the yellow spots but these are found to readily shade into one another.

2. **Salamandra Corsica**, Savi. (12, b)

Synonym, *Salamandra moncherina*, Bonaparte.

Color black; upper surfaces with numerous, large, irregular, yellow, spots; head, muzzle, nostrils, eyes, parotids, grooves, and appearance of the body as in *S. maculosa*; teeth in four longitudinal rows, the two outer somewhat curved, the inner *parallel for more than two*

thirds the length, and then curved so as to enclose an oval or circular space.

Length 6.3 inches.

Tail 3.15 "

Habitat Corsica, Sardinia, and Algeria.

Found in damp places.

3. *Salamandra atra*, Laurenti. (5)

THE BLACK SALAMANDER.

Synonyms, *Lacerta Salamandra*, Gmelin; *Salamandra nera*, Bonaparte; *Salamandra nigra*, Gray.

Color uniform black; head depressed; interval between the parotids nearly cruciform; gular fold well marked; costal furrows distinct; lateral pores present; tail annulate, tapering, compressed, but not carinate.

Length 4 4-5 inches. Head to axilla .8 inch.

Tail 2 2-5 " Diameter of body .5 "

Habitat Mountains of Southern Europe near the snow line.

Reproduction viviparous. The mother brings forth two young, and can expel them upon the land instead of in the water,

II. **Salamandrina**, Fitzinger.

Palatine teeth in two arched rows nearly contiguous in the front half of their course, and widely separated behind; tongue oblong, entire, free laterally and posteriorly; skull much depressed, broad; fronto-temporal arch distinct, but joined to the cranial bones; body granular; ribs well developed; tail long, subcylindrical; toes four in front and five behind.

1. **Salamandrina perspicillata**, Fitzinger. (12, b)

Synonyms, *Salamandra tridactyla*, Daudin, Bonnaterre; *Molge tridactylus*, Merrem; *Seiranota condylura*, Barnes; *Seiranota perspicillata*, Gray.

Back dark brown or black, with a half-circular line of ruddy yellow upon the head, the ends of which point towards the eyes; below whitish, with dark brown or black spots; lower part of the feet and tail red; under jaw white; body slender; lateral line of pores wanting; vertebral region with a chain-like process, which is continued upon the tail, the latter with knotty lateral protuberances.

Length $3\frac{1}{2}$ inches.

Tail 2 1-5 inches.

Habitat Appenines of Tuscany.

12. **Pleurodeles**, Michæelles.

Palatine teeth in two longitudinal, almost parallel rows which terminate anteriorly much in front of the inner nares; *tongue* small, round, or oval, slightly *free posteriorly and laterally*; skull depressed; fronto-temporal arch distinct; ribs greatly developed; parotids present; lateral line of pores low down between the axilla and groin; tail long, compressed; toes four in front, and *five behind*.

Pleurodeles Watlii, Michæelles. (12, b)

Synonyms, *Salamandra pleurodeles*, Schlegel; *Pleurodeles exasperatus* ? Dumeril and Bibron.

Brown or whitish gray, with yellow marblings and dark spots, more yellow upon the sides; body short and thick; skin granular above, smooth below; gular fold distinct; tail and limbs, as well as fingers and toes, slender.

Length $7\frac{1}{2}$ inches.

Breadth of head .9 inch.

Tail 4.7 "

Habitat Spain.

13. **Bradybates**, Tschudi.

Palatine teeth few; tongue very small, round, adherent by its whole under surface; parotids none; body short, broad, the sides perforated by the ribs; toes four in front and five behind.

Bradybates ventricosus, Tschudi

Color brownish yellow, with darker spots; head depressed; eyes small and remote from each other; nostrils almost under the eyes; tail short, subcylindrical, and differs from the uniform one of *Pleurodeles*; body depressed, very thickly covered with fine warts.

Habitat Spain.

Dumeril and Bibron consider this a young *Pleurodeles*, as it possesses many of the characteristics of that genus, and differs from it mainly in the form of the tail. Hallowell cites a specimen in the Bonaparte Collection, of the Academy of Natural Sciences, labeled *Bradybates Poirleti*, which he says is evidently a young *Pleurodeles*. He also quotes Tschudi as saying of this species, "Zahne ganz Plethodon," but considers it manifestly an error.

14 **Notophthalmus**, Rafinesque.

Synonyms, *Diemyctylus*, Rafinesque, Cope; *Cynops*, Tschudi; *Taricha*, Gray.

Teeth in two longitudinal series, closely approximated in front, divergent behind; tongue attached anteriorly and posteriorly, and with only a small portion of its lateral margins free; postorbital arch long and strong, formed by the union of the tympanic and frontal bones; palatine processes cuneiform; spinous processes of vertebræ quadrangular; ribs rudimentary; tail small, compressed from the base; toes four in front and *five* behind the first and fifth rudimentary.

Spots beneath numerous and black. (a)

Spots beneath few or none. (b)

a. Skin smooth *N. VIRIDESCENS*. (1)

a. Skin above rough *N. PYRRHOGASTER*. (3)

b. Skin much granulated. (c)

b. Skin slightly granulated *N. LÆVIS*. (4)

c. Color beneath bright yellow. *N. TOROSUS*. (2)

c. Color beneath plumbeous. *N. CHINENSIS*. (5)

1. **Notophthalmus viridescens**, Rafinesque.

THE CRIMSON SPOTTED TRITON.

Synonyms, *Triturus viridescens*, Rafinesque; *Diemyctylus viridescens*, Rafinesque, Hallowell, Cope, Allen; *Diemyctylus miniatus*, Rafinesque, Hallowell, Cope, Allen; *Salamandra stellio*, Say; *Salamandra symmetrica*, Harlan, Holbrook, De Kay, Storer; *Salamandra punctatissima*, Wood; *Salamandra dorsalis*, Harlan, Holbrook, Storer; *Salamandra millepunctata*, Storer; *Salamandra coccinea* ? De Kay; *Notophthalmus miniatus*, Storer; *Triton millepunctatus*, De Kay; *Triton dorsalis*, Hall; *Triton symmetricus*, *punctatissimus*, et *dorsalis*, Dumeril and Bibron.

Color varying from olive to scarlet above, from orange to red beneath, the two colors abruptly separated; sides with five or more ocellate spots, often arranged in a line and sometimes with other similar but smaller spots lower down; entire under surface punctate with black dots, which sometimes cover the back and tail as well; head oval; muzzle rounded at the apex; commissure of the mouth not extending behind the posterior canthus of the eye; gular and postorbital folds wanting; costal grooves about fourteen, indistinct; back usually with a dorsal

crest; tail strongly carinate above and below; limbs long and slender.

Length	$3\frac{1}{4}$ inches.	Head to axilla	$\frac{1}{2}$ inch.
Tail	$1\frac{3}{4}$ “	Breadth of head	$\frac{1}{4}$ “

Habitat Maine and Vermont to Florida, Illinois, and Northern Shore of Lake Superior. Common.

Found under stones, and decayed wood, and also in brooks. Holbrook observed them swimming with vivacity under ice an inch thick. Storer found fragments of *Lymnea* and *Physa* in their stomachs, and also ascertained that they cast their skin in June, and that the new cuticle was similar in all respects to the old.

2. *Notophthalmus torosus*, Eschscholtz.

Synonyms, *Triton torosus*, Eschscholtz, Hallowell; *Triton ermanni*, Wiegman; *Triton granulosus*, Skilton, Hallowell; *Taricha torosus*, Gray, Hallowell; *Diemyctylus torosus*, Cope.

Color dark brown, beneath yellowish; body strong, in alcohol very much granulated; head large, ovate; muzzle angular, rounded at apex; teeth not contiguous in front; commissure decurved under the eye; gular fold well marked, other folds and costal grooves indistinct; limbs long and strong; tail compressed so as to form a fin above and below.

Length	5 7-8 inches.	Head to axilla	7-8 inch.
Tail	3 “	Breadth of head	$\frac{5}{8}$ “

Habitat Oregon City and San Francisco.

3. *Notophthalmus pyrrhogaster*, Boie.

Synonyms, *Molge pyrrhogaster*, Boie; *Salamandra subcristata*, Schlegel; *Cynops subcristatus*, Tschudi; *Cynops pyrrhogaster*, Gray; *Triton subcristatus*, Dumeril and Bibron, Hallowell; *Diemyctylus pyrrhogaster*, Cope.

Color above deep brown, often with scattered yellow spots; beneath red, with numerous irregular black spots or dots; head large, flattened; muzzle obtuse; body warty, or with a very granular skin above, and with lateral tubercles at the origin of the throat; dorsal crest small and almost effaced.

Length 5 inches.

Tail $2\frac{3}{4}$ "

Habitat Europe, Northern Africa, and Japan ?

Common in the stagnant water of the overflowed fields.

4. *Notophthalmus lævis*, Baird and Girard.

Synonyms, *Taricha lævis*, Baird and Girard; *Diemyctylus lævis*, Cope.

Baird and Girard (27, d) give a very imperfect description of this as follows:

“Allied to *T. toroso*, gray, but smoother, having but slight indications of granulations. Tail very much compressed, with a fringe along the upper edge, and the posterior half of the lower. Color above dark purplish brown, beneath bright yellow, the line of demarkation very distinct. Body 3 inches long; tail $4\frac{1}{2}$.”

Habitat San Francisco.

5 *Notophthalmus Chineensis*, Gray.

Synonyms, *Cynops Chinensis*, Gray.

Color above olive brown, beneath bluish black, with small, irregular, yellow spots on the gastræum, and under sides of the limbs; tail yellowish on its under edge; sometimes gray above, margined with black; skin granular; head and parotid glands similar to *N. pyrrhogaster*; size large.

Habitat North Eastern Coast of China, inland from Ningpo.

15. **Triton**, Laurenti.

Palatine teeth in two longitudinal series, almost parallel or approximated in front, and divergent behind; tongue fleshy, papillose, round or oval, free only upon its sides, in *T. punctatis* slightly so all around; fronto-temporal arch usually incomplete or wanting; parotids not very prominent; body smooth or warty, flattened below; digits developed, four in front and five behind; tail much compressed, with vertical cutaneous margins at the period when the animal inhabits fresh water.

This genus is especially difficult to understand. This difficulty results from the changes they undergo. Sometimes they exist upon the land, and then resemble the terrestrial Salamanders. At other times, especially near the epoch of fecundation, they betake themselves to water, assume more beautiful and varied colors, produce a dorsal crest in the male, and exchange their round tail for one exceedingly compressed. These changes are so great, and the difference between the sexes so marked, as well as the variations due to age, that at times we can scarcely believe that certain animals observed are the offspring of a common parent. Robin (34) has some very interesting observations on the fecundation of *Triton cristatus*, *alpestris*, *palmatus*, and *punctatus*. He there shows that in them, as also in the *Siredon*, spermatozoids

occur in the female cloaca, and to some distance up in the oviducts. These were found in pregnant females not engaged in oviposition as well as those that were, thus showing that the eggs were fecundated some time prior to leaving the mother.

Perhaps the best analysis that can be given is the following modeled after Dumeril and Bibron:

Skin of the back rugose. (a)

Skin of the back smooth. (d)

a. Belly spotted black. (b)

a. Belly immaculate. (c)

b. Palatine teeth in two nearly parallel rows.

T. CRISTATUS. (1)

b. Palatine teeth contiguous in front, widely divergent behind. T. BLASII, (8)

c. Dorsal band wanting. . . T. MARMORATUS. (2)

c. Dorsal band large, yellow.

T. PYRENÆUS. (7)

d. Belly spotted black. (e)

d. Belly immaculate. (f)

e. Spots large, round; no yellow lateral band.

T. PUNCTATUS. (3)

e. Spots simply dots; large yellow lateral band.

T. VITTATUS. (5)

f. Fronto-temporal arch incomplete; lateral line of pores none; color cinereous.

T. ALPESTRIS. (4)

f. Fronto-temporal arch complete; lateral line with distant, single pores; color tawny.

T. PALMATUS. (6)

*1. **Triton cristatus**, Laurenti. (20, 42)

Synonyms, Salamandra aquatica, Wurfbaïn, Ray, Petiver, Daleus, Daudin; Salamandra Batracon, Camerarius; Salamandra platyura, Daubenton; Salamandra laticauda, Bonnaterre; Salamandra cristata et pruinata, Schneider; Salamandre cretee, Latreille; Salamandra platycauda, Rusconi; Lacertus aquaticus, Gesner, Gronovius; Lacerta palustris, Linnæus; Lacerta porosa, Retzius; Lacerta lacustris, Blumenbach; Molge palustris, Merrem; Hemisalamandra cristata, Duges; Triton marmoratus, Bibron; Triton cristatus et Bibroni, Bell; Neurergus crocatus ? Cope; Chioglossa ? Du Bocage.

Color above brownish green to black; beneath *orange* with *black spots* of considerable size; upper surfaces with dark blötches more or less distinct; sides with similar dark markings and projecting white points; head long, much depressed; muzzle round; palatine teeth in two long, widely separated, and nearly parallel rows terminating anteriorly in front of choane; inner nares large, equidistant from the outer; nostrils moderate; eyes elongated; commissure terminating under the orbit; gular fold usually well marked; dorsal crest well developed, reaching from muzzle to tip of groin; limbs

*For Hybridation in this animal (see 42, b) and for showing that the limbs may be amputated and regenerated, but not if their basilar portion has been removed, (see 35, a and c,) and for reproduction (see 45, a.)

moderate; inner toes very long and free; feet flattened, with two well marked plantar tubercles; tail much compressed, with a membrane or fin above and below.

Length $4\frac{3}{4}$ inches. Head to gular fold 7 lines.
Tail 2 " Breadth of head $5\frac{1}{2}$ "

Habitat Europe and Northern Africa. Common.

Dumeril and Bibron (12, b) recognize three varieties.

A. Very large, 8 inches long, black above, and the white lateral points wanting. B. Length four to five inches, brown above, or grayish in the males. C. *Triton carnifex*, Laurenti, are females of small size, without dorsal crest.

In a specimen before me from Leeds, England, one hind foot has seven toes, of which the anterior three are distinct, the other four all united at the base, and in pairs towards the tips, the pairs being digitally distinct, and each toe separate at the very tip. In other specimens this abnormal development (which is probably a result of injury) does not occur.

Cope (31, g) describes as *Triton subcristatus* an animal which probably belongs here. The only points of difference which appear in his description are the absence of the white lateral dots, and the relative length of the tail. He also quotes Schlegel to show a different osteology for the head and a less number of vertebræ, both of which, without seeing the specimen in question, seem to me doubtful.

Habitat Loo Choo Islands.

2. **Triton marmoratus**, Latreille. (12, b, 42)

Synonyms, Triton Gesneri, Laurenti, Schneider; Triton carnifex, Laurenti, Bonaparte; Salamandre marbree, Latreille, Daudin; Hemisalamandra marmorata, Duges; Pyronicia marmorata, Gray.

Color greenish, marbled with black or brownish red, with white points; dorsal band red or yellow; belly immaculate; body strong; lateral line of pores well marked; skin subtuberculose; costal furrows not prominent; limbs stout; hinder toes somewhat fringed.

Length 6 inches.

Tail 2.6 inches.

Habitat France and Portugal.

A variety, or rather three varieties, of *Triton cristatus* ?

3. **Triton punctatus**, Latreille.

Synonyms, Triton Parisinus, Laurenti; Salamandra tæniata, Schneider; Salamandra punctata, Latreille, Daudin; Salamandra elegans, Daudin; Molge punctata, et cinerea, Merrem; Molge tæniata, Gravenhorst; Lisotriton punctatus, Bonaparte, Bell, Cope; Lophinus

punctatus, Gray; Triton lævis, Higginbottom, Pyronicia punctata, Gray.

Color greenish to yellow above, with round black spots arranged in rows, and with five lines of black upon the neck; beneath yellow, with large round black spots arranged in two or three lines; dorsal crest of males at epoch of fecundation very distinct.

Length $2\frac{1}{2}$ inches.

Habitat France.

4. **Triton alpestris**, Laurenti.

Synonyms, Triton Wurffbanii, Laurenti; Salamandra rubriventris, Daudin; Molge alpestris, Merrem; Lissotriton alpestris, Bonaparte; Hemitriton alpestris, Duges, Gray.

Color above cinereous, with black spots along the sides and margin of the lower jaw, and thus border the gastræum: ventral and gular region orange, immaculate, red during life; limbs and feet spotted with black, with half rings; digits slender, depressed; tail large, almost transparent, with numerous black spots below.

Length $2\frac{1}{2}$ inches.

Habitat Italy and Austria.

5. **Triton vittatus**, Gray.

Synonyms, *Molge vittatus*, Gray; *Ommatotriton vittatus*, Gray; *Lissotriton palmipes* Var., Bell.

Color above grayish white, with black dots arranged in lines; sides with a large, yellow band, margined above and below with black; beneath red or yellow with black spots; body smooth; lateral line of pores single, distinct; dorsal crest present in males, but interrupted over the loins; legs membranous on their inner edge; plantar tubercles subulate, present in front.

Length 3 5-6 inches.

Tail $1\frac{3}{4}$ inches.

Habitat England, France, and Belgium.

Dumeril and Bibron consider this species as doubtful and intermediate between *Triton alpestris* and *T. palmatus*.

6. **Triton palmatus**, Schneider.

Synonyms, *Salamandra exigua*, Laurenti, Rusconi; *Salamandre suisse*, Ragoumowski; *Salamandra palmata*, Schneider; *Salamandre palmipede et abdominale*, Latreille, Daudin; *Salamandre abdominale*, Bonaparte;

Triton exiguus, Bonaparte; *Triton minor*, Higginbottom; *Molge palmata*, Merrem; *Lophinus palmatus*, Gray; *Lissotriton palmatus*, Bell, 1849.

Color various, above usually brownish olive, green, or tawny, with black spots often arranged in two lines; beneath orange or yellowish often with a few black spots irregularly distributed; tail with a large cream-colored band on each side, margined with black dots; female paler; palatine teeth in two not contiguous series; body smooth or slightly granular; lateral lines of distant, single, indistinct, pores; dorsal crest in male present at times; back with three ridges; feet in male palmate, in female free; tail usually compressed and often terminating distally in a filament.

Length $2\frac{2}{3}$ inches.

Habitat England, France, and Germany.

Higginbottom states that at the time of reproduction the tail in the male is terminated by a filament three lines long, and the hind feet entirely palmate; but after the breeding season is past, the filament and membranes are absorbed, leaving the tail with a round tip, and the toes free.

7. *Triton Pyrenæus*, Dumeril and Bibron.

Color above brown, with a large yellow dorsal band, the margins of which are dentated and marked with

numerous black dots; beneath reddish yellow, immaculate; body warty; tail much compressed.

Length $3\frac{1}{2}$ inches.

Habitat Pyrenees.

8. **Triton Blasii**, De l' Isle, (42)

Color above green with brown, undecided spots; below orange, often white or whitish upon the sides, with circular black spots; dorsal band of a silver shade in the males, yellow in the females; feet orange; digits with black rings; head elongated: muzzle round; palatine teeth contiguous in front, widely divergent behind; gular fold distinct; body large and robust; dorsal crest in male very prominent, serrate above; pelvis articulated to the fifteenth or sixteenth vertebra; skin tuberculose, especially upon the back and sides; tail short, very much compressed; toes distinct.

Length 7.16 inches.

Tail 3.23 “

Habitat France.

16. **Euproctus**, Gene.

Palatine teeth in two longitudinal rows somewhat converging towards the front; *tongue adherent anteriorly, free posteriorly and laterally*; vomero-palatine processes cuneiform; head large; muzzle round; parotids none; skin rugose or warty; tail compressed; toes four in front and *five behind*.

Palatine series of teeth closely approximated in front; skull elongated; fronto-temporal arch weak.

E. PLATYCEPHALUS. (1)

Palatine series widely separated; skull rounded; fronto-temporal arch strong... E. POIRETI. (2)

1. **Euproctus platycephalus**, Otto.

Synonyms, *Molge platycephalus*, Otto; *Euproctus Rusconii*, Gene, Gray, Dumeril and Bibron; *Megapterna montana*, Savi; *Hemitriton asper et punctulatus*, Duges; *Calotriton punctulatus*, Gray; *Triton glacialis*,

Phillippe; Triton punctulatus, cinereus, rugosus, Bibronii, et repandus, Dumeril and Bibron.

Body above brownish olive, with traces of black; beneath gray, with black or bluish black points or spots; head and skull rhombic; tongue oval; pterygoid and superior maxillaries united by the mediation of a jugal bone; lateral line of pores wanting; cloaca usually prolonged.

Length $2\frac{3}{4}$ inches.

Habitat Spain, Pyrenees, Italy, Corsica, and Sardinia.

2, **Euproctus Poireti**, Gervais. (12, b)

Synonyms, *Lacerta palustris*, Poiret; Triton Poireti, Gervais, Gray; Triton nebulosus et Euproctus Rusconii, Guichenot; *Glossoliga Poireti*, Bonaparte, Gervais, Gray, Cope.

Brown above with black spots; beneath paler with buff and brown; head and skull semicircular; forehead flattened with scattered tubercles tipped with brown; muzzle rounded; fronto-temporal arch complete and strong; nares more separated than in the preceding species; pterygoid and maxillary bones united directly with one another; lateral pores single, small, arranged

in a continuous line ; tail longer than the body, with a yellow band extending to its tip.

Length $6\frac{3}{4}$ inches. Breadth of head .59 inches.

Tail $3\frac{1}{2}$ "

Habitat Northern Africa.

List of Salamandrida unknown to the writer either by a specimen or a good description:

TRITON ENSATUS, Eschsch. Zool. At, Pt. V. Pl. 22, figs. 1-12.

Habitat San Francisco.

SALAMANDRA TERETICAUDA, Eschsch. Zool. At. Pt. V. p. 14.

Habitat San Francisco.

SALAMANDRA GREENI, Gray. Catalogued in Griff. Cuv.

SALAMANDRA BEECHEYI, Gray, Zool. of Blossom Pl. 31, fig. 3. Catalogued in Griff. Cuv.

SALAMANDRA OCELLATUS, equal to SIMILIS, Fitz. Fitz. neue Class. Rept. 1825.

SALAMANDRA SINCIPUT-ALBIDA, Green, Jour. Acad. Nat Sci. 1818, p. 352.

Habitat New Jersey.

?TRITURUS LUTESCENS, Rafinesque, 1832 Atlantic Jour. No. 3, p. 121.

Habitat Kentucky.

TRITURUS HYPOXANTHUS, Raf. 1820 Annals of Nature, No. 20.

Habitat Kentucky.

TRITURUS NEBULOSUS, Raf. 1820 Annals of Nature; No. 23.

Habitat Long Island.

OPHIOMORPHA, Nicholson.

Synonyms, Gymnophyona, Rolleston, Cope, Huxley; Apoda, Bell, Tenney, Swainson; Peromeles, Dumeril and Bibron.

This order comprises but a single family, Cæciliadae, and hence in the present state of knowledge the same characteristics will answer for both order and family. Should subdivisions ever be made it will then be time enough to provide separate descriptions.

CÆCILIADÆ.

Body vermiform; limbs wanting; young with internal branchiæ, and a branchial aperture on each side of the neck; adult with lungs, the left being relatively very small; eyes small, almost concealed, or wanting; skin apparently naked, viscous, with many folds or wrinkles, and containing numerous delicate, horny, rounded, dermal scales; tongue large, papillose, fixed in the cavity of the jaw, neither forked nor protusible; nostrils open behind the palate; heart with two cavities, at least the auricle not sufficiently divided to be regarded as double;

lobes of liver many, in numerous transverse lamellæ; bones of skull soldered together; orbits of eyes covered by maxillaries, and resemble a small hole; maxillary and palatine teeth in two concentric lines; hyoid bone composed of three pair of arches; ossiculum auditum or auditory bone a small plate on the fenestra ovalis; os quadratum soldered immovably to the cranium; rami of lower jaw united by symphysis at the chin; occipital condyles two; vertebræ amphiœelous.

From the above characters it will be seen that the Cæilians are like the Ophidians in, (1) the form of the body; (2) the absence of limbs; (3) the presence of dermal scales; (4) the relative size of the lungs; and (5) the teeth, which are long, tapering, and directed backwards. They were in fact classed with the serpents in the writings of Goldfuss, Voight, Cuvier, and the older naturalists, and it was only when Muller discovered the pores at the side of the neck of a young *E. glutinosa*, with branchial fringes within upon the corners of the hyoid, that they were assigned their true position. The characters serving to distinguish them from the Ophidia are, (1) the presence of two occipital condyles; (2) the amphiœelous vertebræ and their union with each other; (3) the dove-tailing of the tympanic bone into the cranium, and solidification of the whole; (4) the symphysis of the lower maxillary and size of the mouth resulting from the manner of its articulation; (5) the cloacal aperture round instead of transverse; (6) the presence of internal branchiæ in the young.

They also somewhat resemble sea-eels among fishes in, (1) the amphiœelous vertebræ and cavities filled with

semigelatinous remains of the notochord; (2) the form and structure of the skeleton; (3) the mode of implanting teeth; and (4) the articulation of the jaw and cranium. But they are unlike fishes in, (1) the presence of two occipital condyles; (2) the nostrils opening into the mouth; (3) the presence of lungs; (4) the absence of branchiæ in the adult.

Again they are very similar to worms, (1) in respect to their viscid, damp, slimy skin; (2) their forms and cuticular folds; (3) their habit of boring into the ground in damp places; (4) their food, vegetable matter, earth and sand having been found in their intestines, but the presence of a vertebral column, and a cerebro-spinal nervous system at once forbids their being grouped with this class.

Taken as a whole they seem to be possessed of a quintuple nature, that is, they are related to the Amphibænæ, Ophidia, Pisces; Vermes, and the true Batrachia. Certainly the discovery of gills places them among the last, though they will always be interesting from their resemblance to the others. They furnish but another illustration of how close is the union between the cold-blooded vertebrates, and how artificial is the best classification of the naturalist.

In endeavoring to subdivide this family we find four genera commonly recognized. The following table, taken with slight changes from the British Museum Catalogue, will enable any one readily to refer an individual to its appropriate place:

Muzzle pitted. (*a*)

Muzzle not pitted.....RHINATREMA. (4)

a. Pit before each eye. (*b*)

a. Pit under each nostril.....CÆCILIA. (1)

b. Rings on the body broad.....SIPHONOPS. (2)

b. Rings narrow.....EPICRIUM. (3)

The matter of a pitted muzzle seems to the writer insufficient to constitute generic distinctions, and were he to follow his own inclinations but one genus would be given under this family. It looks very much as if nature had only made one, and man had devised the other three. But since these terms have come into general use, and as our knowledge of these animals is very incomplete; and since it is a source of great confusion to vary from established names, it has been deemed best to retain the four genera.

1. **Cæcilia**, Wagler.

Fossa two, one below each nostril; eyes distinct or indistinct; body and head cylindrical; muzzle projecting; tongue velvety or cellular, and usually supplied with two narial valvules.

PACHYNEMA.	IBYARA.	GELATINOSA.	KAUPII.
.....	One foot.	One foot.	.....
.....	One inch.	3-5 inch.	.....
.....	Black, with white ridges.	Brownish.	.....
170-180.	25 Distinct.	300-400,	.....
.....	Obtuse.	.....	.....
Visible in adult.	.....	.....	.....
With Narial Valvules	.....	.....	.....
.....
Ecuador.	Brazil and Guiana	.....	Angostura.

Synonym, *Cæcilia albiventris*, Daudin, Merrem, Gray,
de Saint-Vincent, Cuvier, Griffith.

Cæcilia.	LUMBRICOIDEA.	TENTACULATA.	ROSTRATA.	COMPRESSICAUDA.	OXYURA.	OCHROCEPHALA	PACHYNEMA.	IBYARA.	GELATINOSA.	KAUPII.
Length.	Two feet.	Two feet.	Thirteen inches.	Nineteen inches.	One foot.	12¾ inches.	.....	One foot.	One foot.	.....
Diameter.	⅓ inch.	4-5 inch.	½ inch.	4-5 inch.	3-5 inch.	¼ inch.	.....	One inch.	3-5 inch.	.....
Color.	Black.	Black, marbled with white below.	Brownish Olive.	Brownish Olive.	Olive.	Yellowish Plumbeous	.....	Black, with white ridges.	Brownish.	.....
Annuli.	Fifteen.	130 odd, Part incomplete.	125 complete.	140 below, incomplete above.	180, only last 30 complete.	200 complete.	170-180.	25 Distinct.	300-400.	.....
Muzzle.	Large, Round.	Large, Round.	Narrow, Obtuse.	Large, Round.	Slightly Narrowed.	Depressed, Narrow, Acute.	.....	Obtuse.	.....	.....
Eyes.	Invisible.	Invisible.	Invisible.	Visible.	Visible.	Invisible.	Visible in adult.	.....	.....	.....
Tongue.	Plicated, with Narial Valvules.	Plicated, with Narial Valvules.	Plicated, with Narial Valvules.	Plane.	Plane.	.....	With Narial Valvules	.....	.....	.....
Posterior Terminus of Body.	Round.	Round.	Round.	Compressed.	Pointed.	Depressed, Obtuse.	.....	.....	.....	.....
Habitat.	Surinam.	Surinam.	Isles Seychelles and Guiana.	Guiana.	Malabar.	Panama.	Ecuador.	Brazil and Guiana	.....	Angostura.

Muzzle pitted. (*a*)

Muzzle not pitted. RHINATREMA. (4)

tongue velvety or cellular, and usually supplied with two narial valvules.

Cæcilia lumbricoidea, Daudin. (12)

WORM-LIKE CÆCILIA.

Synonyms, *Cæcilia gracilis*, Hemprich, Shaw; *Cæcilia lumbricoidea* of most authors.

Length more than seventy times the greatest diameter; annuli few at each end, others seen only with the microscope; muzzle large and rounded; eyes invisible; tongue with plicæ and large, oval, narial valvules; posterior extremity of the body cylindrical, and rounded; color blackish or brownish, sometimes with an olive taint; maxillary teeth about twenty in each jaw, palatine or second row sixteen above and ten to twelve below, all the teeth acute, conical, turned backwards, and somewhat scattered; posterior half of the body smaller than the anterior, and with a small swelling near the extremity; scales large, thin, cycloid, imbricated, and verticillate.

Habitat Surinam.

Cæcilia tentaculata, Lacepede. (12)

Synonym, *Cæcilia albiventris*, Daudin, Merrem, Gray, de Saint-Vincent, Cuvier, Griffith.

Length about thirty times its greatest diameter; annuli 130 odd, extending the whole length of the body, but (every other one not forming a complete circle?); muzzle large and rounded; tongue with plicæ and two large, oval, narial valvules; posterior part of the body cylindrical with rounded end; color blackish, *belly marbled with white*; teeth, first row in each jaw about twenty, second row from ten to a dozen below, and sixteen above, all the teeth conical, acute, and turned backwards; scales large, quadrilateral with rounded angles, and imbricated.

***Cæcilia rostrata*, Cuvier.**

SHARP-NOSED CÆCILIA.

Length twenty to twenty-one times its greatest diameter; annuli 125, forming complete circles; eyes and tongue as in *C. lubricoidea*; *muzzle narrow, with end obtuse* or slightly pointed; posterior part of the body cylindrical, with extremity rounded; color brownish olive throughout; scales oval and smaller than in *C. tentaculata*; narial fossæ very small.

Habitat South America and the Isles Seychelles. The occurrence of this animal in regions thus separated and possessing such distinct faunas, is certainly remarkable and well worthy of note. It opens up an interesting question in regard to geographical distribution, and furnishes an excellent opportunity to theorize on how they came there.

Cæcilia compressicauda, Dumeril and Bibron.

Length twenty-five times its greatest diameter; annuli 140 below, *incomplete above*; muzzle large, rounded at the end; tongue plane; *posterior part of the body considerably compressed*; color brownish olive throughout; eyes visible.

Habitat Cayenne.

This species has been made exceedingly interesting by the researches of Peters. Prior to this M. Leprieur had discovered accidentally that some of the Cæciliæ were viviparous or ovoviparous, but the species upon which his observations were made was not determined. Peters (15, b) with a female *Cæcilia compressicauda* which had been captured near Cayenne floating upon the top of the water, determined over again this interesting fact. Soon after its capture this animal gave birth to a young one, and upon dissection five others were found in a dilatation of its oviduct.

The young and the fœtuses were from 5.35 to 5.79 inches long, and what is very remarkable, were without either anal fringes or branchial apertures, both of which are present in the young *Epicrion glutinosum*. In this case however, neither internal branchiæ nor branchial slits could be discovered. Rather there were present in the nuchal region two vesicles 2.17 inches long, of irregular form, and with their narrow, transverse bases in connection. These receive a vascular trunk, and the

same ramifies over their surfaces, and in the scars left by the vesicles in detaching themselves there remains a small hole on each side of the neck, and to this as an opening runs a vessel or pair of vessels in communication with the Aortic arch.

These vesicles are evidently external branchiæ, and their discovery shows still more closely the relation of these animals to the Amphibians. They recall the external branchiæ discovered by Wienland in the larval *Notodelphys ovifera*, and show certain interesting relations between the young Cæcilians and some of the tree toads.

The researches of Peters upon this animal are exceedingly interesting, because they apparently indicate that this order hitherto so imperfectly understood begin their existence as external, then change to internal gill-breathers, and finally replace these by true lungs.

Cæcilia oxyura, Dumeril and Bibron.

Length about twenty times its greatest diameter; annuli exceeding 180, part incomplete; muzzle slightly narrowed; *tongue without narial valvules*; posterior extremity of the body cylindrical, with pointed terminus; eyes visible; scales small, transparent, striated concentrically, imbricated and verticillate; color olive, borders of annuli yellow.

Habitat Malabar.

Cæcilia ochrocephala.

Length about fifty times its greatest diameter; annuli 200, equidistant, complete, and with intermediate ones on the back, beginning one inch and terminating three lines from the posterior extremity; eyes invisible; muzzle narrowed somewhat, decurved, extending at an acute angle beyond the mouth; color plumbeous yellow, throat and head ochreous, annuli brownish black; posterior extremity of the body depressed and obtuse.

Habitat Panama.

Cæcilia pachynema, Gunther.

Annuli 170 to 180; eyes visible in small, invisible in large animals; tongue with two narial valvules; maxillary teeth eight on each side above and six below; palatines five on each side, all the teeth conical and directed backwards; color brownish, sometimes with lateral blue spots.

Habitat Ecuador.

Cæcilia Ibyara, Margrave.

Length about twelve times its greatest diameter; annuli 25, distinct; muzzle blunt; color black, white ridges.

Daubenton (21) makes this synonymous with *C. tentaculata* and *C. rugis*; Linnæus, but that is evidently an error. Bonnaterre (20, p. 73, pl. 34) figures and describes a species under this name, but he has evidently confounded it with *C. tentaculata* and an *Amphisbæna*. Dumeril and Bibron (12) also express doubt as to whether it is not properly one of the last named genus. Not having a specimen I am unable to determine its true relation, but am inclined to think the species well founded, and for this reason have inserted it here. The animal has been found living three feet under ground in wet places.

Habitat Brazil and Guiana.

Cæcilia gelatinosa.

Length twenty times its greatest diameter; annuli between 300 and 400; color brownish.

This may be a variety of *E. glutinosum*.

Cællia Kaupii, Berthold.

This species is described in the *Gottingen Nachrichten*, (1859, p. 161) but being without either the work or a specimen, the writer is unable to give a description here.

Habitat Angostura.

Cæcilia maculata, Catesby.

This is no *Cæcilia* at all, but is the *Anguis ventralis*, Linnæus.

CÆCILIA SQUALOSTOMATA is unknown to the writer.

Habitat Africa.

2. Siphonops, Wagler.

Fossa two, situated in front of and below the eyes; body and head cylindrical; muzzle short; tongue plicated and

without narial valvules; eyes visible; annuli broad; tentacles on the fossa wanting.

Siphonops annulatus, Wagler. (12)

Synonyms, *Cæcilia interrupta*, Cuvier; *Cæcilia annulata* of many authors.

Length 23 inches; diameter .7 of an inch; *annuli 86 to 100, usually forming complete circles*; muzzle large with rounded end; teeth conical and directed backwards; posterior extremity of the body rounded; scales concealed if not altogether wanting; *color blackish, olive, bluish, or ash colored, annuli with white circles.*

Spix estimates upwards of 200 bands or folds of the skin on the body of this animal, but probably none can be found with that number. The *S. annulatus* lives in marshes several feet under ground, and is specifically the same as *C. interrupta*, Cuvier. In the latter, part of the annuli do not form complete circles.

Siphonops Mexicanus, Dumeril and Bibron.

Length 13½ inches; diameter 4-5 of an inch; muzzle slightly narrowed; teeth conical, curved backward; *an-*

nuli about 160, of which the first 50 and last 20 only form complete circles; posterior extremity of the body rounded at the end; scales small, numerous, and imbricated; color yellowish below and grayish above.

Habitat Mexico.

Siphonops syntremus, Cope.

Muzzle depressed, projecting, rounded in front; mandibular teeth five on each side and large; annuli about 130, complete, and with intermediate, lateral segments on the posterior third of the body; annuli ventrally interrupted in front and the segments becoming complete circles behind; posterior extremity of the body with a depressed, pointed terminus; body as a whole slender, cylindrical; eyes very small, barely visible; postgular and gular folds present; nostrils open internally at some distance behind the palatine arch; color dark, plumbeous with yellow lines upon the annuli; length one foot; diameter $\frac{1}{4}$ of an inch; "Differs from the four species hitherto known by the close approximation of the narial and tentacular openings; the latter lie a little behind the former, and are slightly larger. * * * It resembles *C. ochrocephala*, from which it is distinguished by position of the foramen and inner nares, also by color and character of annuli." Cope, (24, e.)

Habitat Belize.

SIPHONOPS BRASILIENSIS, Lutk, and *SIPHONOPS INDISTINCTUS*, Lutk, are both unknown to the writer.

Habitat Brazil.

3. **Epicrium**, Wagler.

Ichthyophis, Fitzinger.

Fossa two below and slightly in front of the eyes; body subfusiform; head depressed; tongue with a velvety surface, and without narial valvules; eyes visible; annuli numerous, complete.

Epicrium glutinosum, Wagler. (20)

JAVANESE CÆCILIA.

Synonyms, *Epicrium Hasseltii*, Wagler; *Ichthyophis Hasseltii*, Fitzinger; *Cæcilia hypocyanea*, Hasselt; *Cæcilia viscosa*, Latreille; *Le Serpent Visquex*, Daubenton; *Le Visquex*, Lacepede and Bonnaterre; *Cæcilia glutinosa* of many authors.

Length 13 inches; diameter $\frac{1}{2}$ inch; annuli 350, being transverse striæ rather than plicæ, and united beneath at an acute angle; muzzle obtuse; scales many, thin, and articulated above; color blackish to grayish, with a yellowish band on each side extending the length of the body.

Habitat Ceylon, Malacca, and Java. Daudin says America, but this is probably a mistake.

Thanks to the researches of Muller, Hasselt, and Peters, we know something of the development of breathing organs in this species. It seems that in a specimen $4\frac{1}{2}$ inches long Muller first discovered the branchial pores, and later, in a specimen 5 lines in length, saw the same more precisely formed. Also Hasselt in one from Java, saw these apertures, and located them in the centre of the yellowish stripe. Peters, (15, a) on the contrary, locates them in the upper border of the stripe, and determines that the forward gill slits are not one-half smaller, as in Muller's example, but the same size as the hinder. He also shows that distinct gills are not present, but projections of the skin beside and between the gill openings are toothed and fringed so as to have allowed the presence of gills. Probably, therefore, they were present at some stage in the animal's development. Also the eyes in the young are much more distinct than in the adult, and directly in front of each is an angular depression larger than the fossa below and in advance of the eye.

Epicrium monochrous, Blecker.

This species is described in *Natuurk, Tijdschr. Med. Indie* xiv. p. 188.

Habitat Borneo.

Rhinatrema, Dumeril and Bibron.

Fossa wanting; body subfusiform; head depressed; tongue velvety, without narial valvules; eyes visible; annuli numerous, complete.

Rhinatrema bivittatum, (12, 23)

THE BANDED CÆCILIA.

Synonym, *Cæcilia bivittata*, of many authors.

Length 7.8 inches; diameter .31 inches; annuli 340, complete; muzzle obtuse; posterior extremity of body pointed; teeth conical, quite narrow, and curved backwards; scales numerous, transparent, circular and reticulated; color black, with a yellow band on each side of the body, yellow anal ring, and with yellow and brown on the lower jaw.

Habitat Cayenne.

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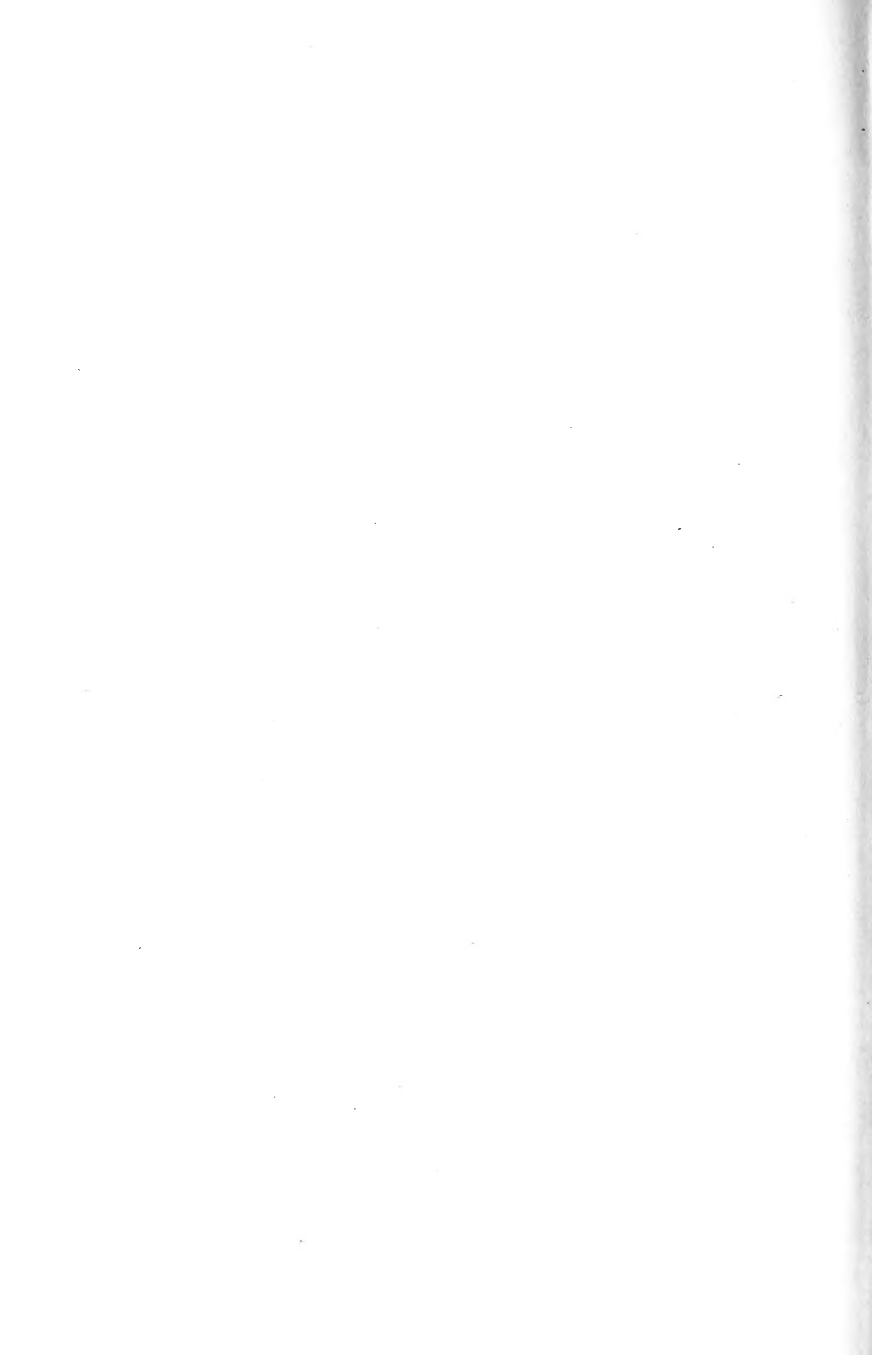
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