

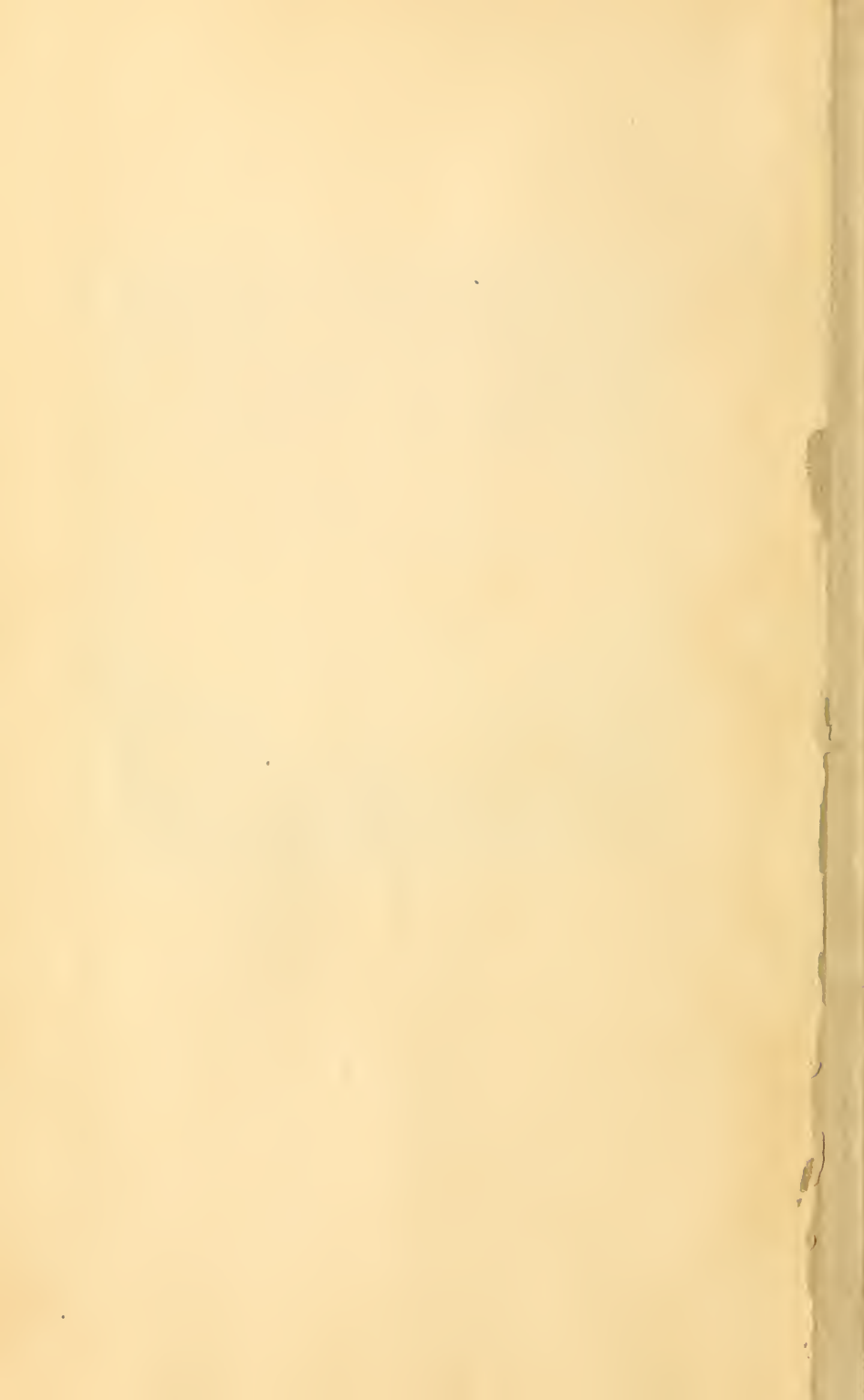
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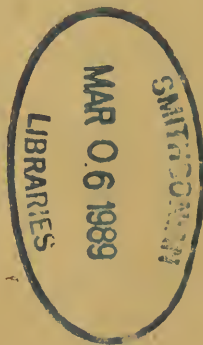
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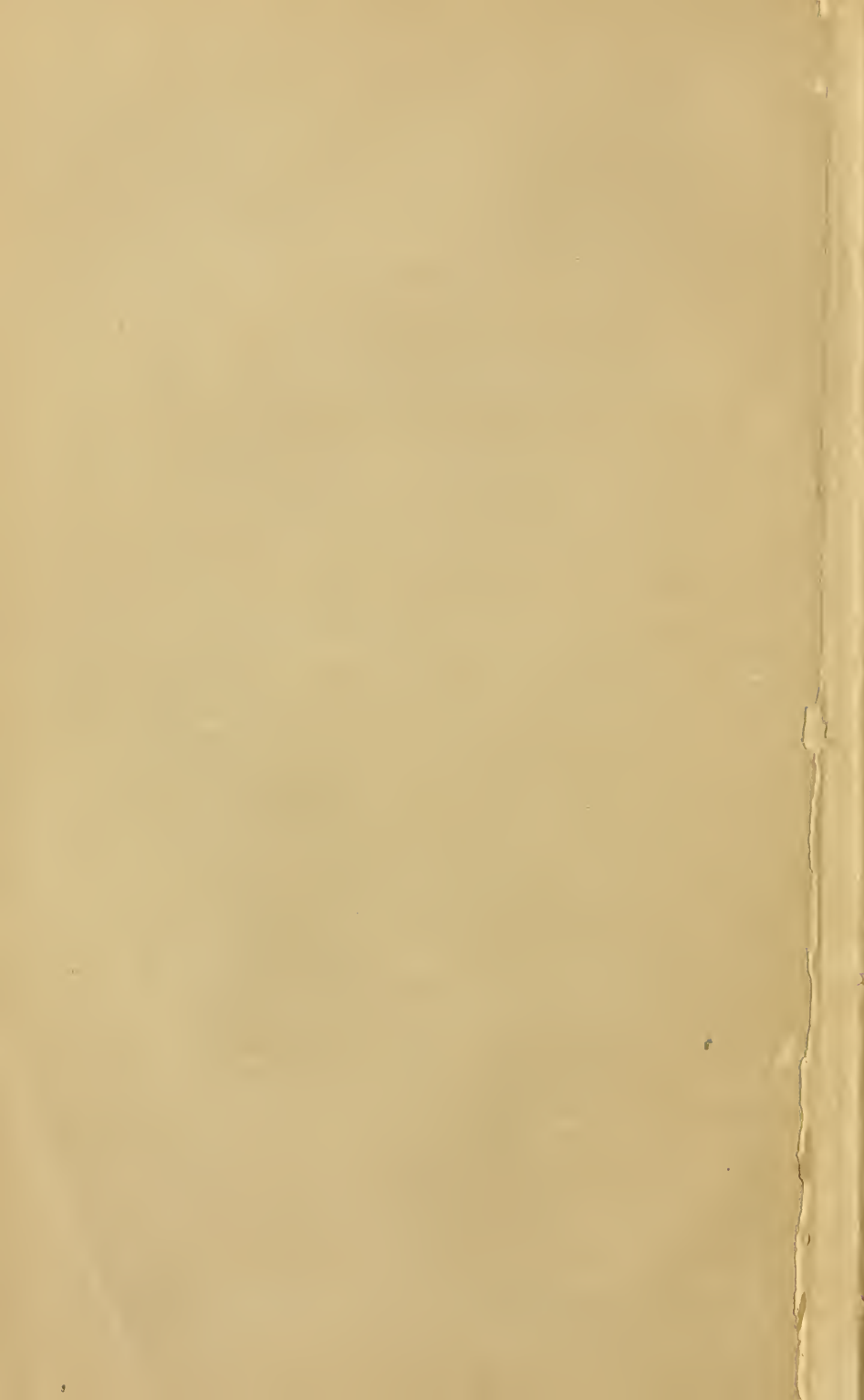
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PORTLAND SOCIETY OF NATURAL HISTORY.

ART. I.—*Observations on the Terrestrial Pulmonifera of Maine, including a Catalogue of all the species of terrestrial and fluviatile Mollusca known to inhabit the State.* By EDWARD S. MORSE.

TWENTY-ONE years ago, Dr. J. W. Mighels, then of Portland, presented to the Boston Society of Natural History a catalogue of the shells of Maine, which was accepted and published by them in the fourth volume of their Journal. Since that time the number of species of terrestrial and fluviatile Mollusca detected in the State has been nearly doubled. To make these additions known, I commenced the preparation of a simple catalogue. Such catalogues, however brief, are of value in the study of geographical distribution, which is rapidly becoming an element of vast importance in the study of Zoölogy. At the same time their value is greatly enhanced by observations concerning the relative scarcity or abundance, habits, etc., of each species. While making these brief notes, I was led to examine the subject still more closely.

This paper, the result of that investigation, is offered as a first contribution to a more intimate knowledge of our native species.

In the preparation of these pages I have received great assistance from W. G. Binney, Esq., of Burlington, New Jersey, to whom I feel under grateful obligations for aid, without which it would have been impossible to present certain species in the light recently thrown upon them by the labors of certain European writers. He

has freely sent me all the works at his disposal, furnishing any desired intelligence on the subject, and by frequent correspondence has decided many perplexing questions concerning synonymy.

Having most unfortunately parted with my own collections, the results of diligent labor for several years, I have depended greatly on the valuable collections of Adjutant John M. Gould and Mr. Charles B. Fuller, of Portland, who placed all their material entirely at my disposal; to these gentlemen I wish to tender my sincere thanks. I am also indebted to the Rev. E. C. Bolles, of Portland, for valuable assistance in numerous microscopical examinations. My thanks are due to Temple Prime, Esq., of New York city, George W. Tryon, Jr., of Philadelphia, and A. E. Verrill, of the Museum of Comparative Zoölogy at Cambridge, for numerous acts of kindness.

Through the generosity and kindness of W. G. Binney, I have had the pleasure of examining Albers' systematic arrangement of the Helicidæ.*

I have adopted the sub-generic names of Albers, as far as it could be done without open violation of the natural characters of the animal. In many cases, however, I have made alterations in his arrangement, proposing at the same time not only new genera, but also several sub-families.†

Nothing can be more artificial than a classification of mollusca based on the shell *alone*, or even on any single organ or portion of the animal. Now, true classification is not artificial; it is the revelation of a natural order. All minor peculiarities play their part only in the grand whole, and therefore we have no right to cull out special points here and there for the arbitrary establishment of convenient groupings. In the following synoptical table I have grouped the species together under certain generic, sub-family,

* Der Heliceen. Leipsic, 1860, 2d Ed. by Von Martens.

† To write out the synonymy of the species here presented would require a special study, and all the conchological works of this country and of Europe at one's command, in order to do it properly. I have had neither this opportunity nor desire, and have concluded to leave this part of the work to other hands. So long as the name of the original describer of a species attends the shell, no confusion need be caused. The species "Labyrinthica. Say", will always be known, whether it be *Helix*, *Mesodon*, *Anchistoma*, or *Strobila*; and for this reason I have retained the name of the original describer of the species.

and family distinctions; basing these groups on the differences or resemblances seen in the structural peculiarities of all the principal parts of the animal, such as the characters of the lingual membrane, form of the buccal plate, contour of the entire animal, and everything I could lay hold of in my limited sphere of observation to guide me in this arrangement. I have been continually on my guard not to lean too much on a single feature, but to consider impartially all parts together. As yet, this can only be done imperfectly, and it will require long and pains-taking research before the end is attained. In fact, the interpretation of the natural subdivisions which I believe to exist in these animals, demands a deeper and more philosophical mode of study, a complete embryological history of all the species, an exhaustive histology and a thorough anatomy of the soft parts; and then whatever may be revealed by such work, will, I believe, be as characteristically stamped on the shell as on the habits and economy of the animal. Finally, the definitions of Professor Agassiz regarding genera, namely, *details of structure*; and of families, namely, *form*, will be the long hidden keys to unlock and make plain the relations of this group.

In a paper now in preparation, on the classification of the Pulmonifera, I shall point out fully my reasons for the following arrangement. Considerations regarding all the forms of this order, and not merely those confined to the State, govern the groupings given in this table.

In the Helicidæ, (as restricted here to those animals which sustain a globose or planospiral shell) we have noticed thus far three principal types of lingual dentition.

(1.) In those larger forms of Helices which we include under the sub-family Helicinæ, we have in the lingual membrane about one hundred rows of plates, with about seventy-five plates in a row. The laterals and uncini are scarcely distinguishable one from the other; in fact they may be said to blend together. The centrals and laterals are unidentate and similar in form; the uncini either unidentate, bidentate, or irregularly notched. The buccal plate is solid, arcuate, its frontal portion strongly marked with longitudinal ribs which crenulate the cutting edge.

(2.) In another group which we designate as Helicellinæ, we have the viscera protected by a thin, glabrous shell; the lingual membrane is nearly as broad as long, having about sixty-eight rows of plates, averaging about forty-two plates in a row; the laterals and uncini are quite distinct; the central plate broad, long, tridentate; the laterals, three to five, bidentate, identical with central, in form of denticles; the uncini unidentate, the denticle being aculeate and re-curved. The buccal plate is thin and crescent shaped, with a middle beak-like projection, lateral terminations pointed.

(3.) In a still smaller group, for which we propose the sub-family name of Valloninæ, we have the lingual membrane composed of eighty or ninety rows of plates, averaging twenty-six plates in a row. The laterals and uncini are generally distinct. The central plate is square, tridentate; the laterals four to five, square, bidentate; uncini broad, short, and minutely serrated. The buccal plate is slightly arcuate, rarely produced centrally; its front surface marked with delicate perpendicular or diverging striæ, faintly notching the cutting edge; the lateral terminations of plate being rounded or blunt.

These three types of lingual dentition are accompanied with like peculiarities in the character of the shell, the external appearance of the animal, and the general size of the species.

Vitrininæ I restrict to *Vitrina*, owing to the value I place on the external characters of the animal. Punctinæ I hold good on the extraordinary character of the lingual dentition and buccal plate peculiar to the species on which this sub-family is based. The other groups we have not considered sufficiently to offer any opinions as to their relative value or position. Taking the number of plates in a row from five different species in each group from Pupinæ upward, and averaging this number for each group, we have the following result:

Limacidæ including Philomycenidæ,	94
Helicinæ,	73
Helicellinæ,	42
Valloninæ,	26
Pupinæ,	24

SYNOPSIS OF THE FLUVIATILE AND TERRESTRIAL MOLLUSCA OF
THE STATE OF MAINE.

NOTE. All names in *Italics* are proposed for the first time. Those families marked thus * have not been examined by the author.

LIMACIDÆ.	<i>Pseudohyalina</i> exigua, Stimps.
ARIONINÆ.	" minuscula, Binn.
Arion fuscus, Müll.	<i>Striatura</i> milium, Morse.
LIMACINÆ.	" <i>ferrea</i> , Morse.
Limax agrestis, Müll.	Conulus chersina, Say.
" flavus, Linn.	VALLONINÆ.
" campestris, Binney.	Vallonia minuta, Say.
PHILOMYCENIDÆ.	Patula striatella, Anthony.
TEBENNOPHORINÆ.	<i>Planogyra</i> asteriscus, Morse.
Tebennophorus Carolinensis,	<i>Strobila</i> labyrinthica, Say.
[Bosc.]	<i>Helicodiscus</i> lineata, Say.
<i>Pallifera</i> dorsalis, Binney.	PUNCTINÆ.
HELICIDÆ.	<i>Punctum</i> minutissimum, Lea.
HELICINÆ.	?
Mesodon albolabris, Say.	SUCCININÆ.
" Sayii, Binney.	Succinea Totteniana, Lea.
" thyroides, Say.	Succinea avara, Say.
Triodopsis dentifera, Binney.	" ovalis, Gould.
Stenotrema monodon, Rackett.	PUPADÆ.
Pomatia aspersa, Müll.	Zua lubricoides, Stimpson.
Tachea hortensis, Müll.	PUPINÆ.
<i>Anguispira</i> alternata, Say.	<i>Zoögenetes</i> harpa, Say.
VITRININÆ.	Pupilla badia, Adams.
Vitрина limpida, Gould.	Leucochila contracta, Say.
HELICELLINÆ.	" corticaria, Say.
Macrocyclus concava, Say.	" pentodon, Say.
Hyalina cellaria, Müll.	VERTIGININÆ.
" indentata, Say.	Isthmia ovata, Say.
" arborea, Say.	" Gouldi, Binney.
" electrina, Gould.	" simplex, Gould.
" <i>Binneyana</i> , Morse.	" milium, Gould.
" multidentata, Binney.	

* AURICULIDÆ.

AURICULINÆ.

- Carychium exiguum*, Say.
Alexia myosotis, Drap.

MELAMPINÆ.

- Melampus bidentatus*, Say.

* LIMNÆIDÆ.

PLANORBINÆ.

- Planorbis lentus*, Say.
Planorbella campanulatus, Say.
Helisoma trivolvis, Say.
 “ *bicarinatus*, Say.
Menetus exacutus, Say.
Gyraulus deflectus, Say.
 “ *parvus*, Say.
 “ *hirsutus*, Gould.
 “ *dilatatus*, Gould.
Planorbula armigera, Say.

PHYSINÆ.

- Nanta elongata*, Say.
Physa ancillaria, Say.
 “ *heterostropha*, Say.
 “ *gyrina*, Say.

LIMNÆINÆ.

- Radix ampla*, Mighels.
 “ *columella*, Say.
Limnophysa elodes, Say.
 “ *desidiosa*, Say.
 “ *caperata*, Say.
 “ *catascopium*, Say.
 “ *humilis*, Say.

ANCYLINÆ.

- Ancylus parallelus*, Hald.
 “ *tardus*, Say.
 “ *fluviatilis*, Say.
 “ *ovalis*, Morse.
 “ *borcalis*, Morse.

* VIVIPARIDÆ.

- Melantho decisa*, Say.

* AMNICOLIDÆ.

- Amnicola decisa*, Hald.
 “ *porata*, Say.
 “ *limosa*, Say.

* VALVATIDÆ.

- Valvata tricarinata*, Say.
 “ *sincera*, Say.
Lyogyrus pupoidea, Gould.

* UNIONIDÆ.

- Anodonta fluviatilis*, Lea.
 “ *marginata*, Say.
 “ *implicata*, Say.
Strophitus undulatus, Say.
 “ *sculptilis*, Ag.
Alasmodonta marginatus, Say.
Margaritana arcuata, Barnes.
Lampsilis ochracea, Say.
 “ *radiata*, Lam.
Unio complanatus, Lea.

* CORBICULADÆ.

- Sphærium sulcatum*, Lam.
 “ *striatinum*, Lam.
 “ *partumeium*, Say.
 “ *tenuë*, Prime.
 “ *securis*, Prime.
 “ *truncatum*, Linsley.
Pisidium Virginicum, Bourgui-
 “ *Adamsii*, Prime. [gnat.
 “ *æquilaterale*, Prime.
 “ *compressum*, Prime.
 “ *variabile*, Prime.
 “ *abditum*, Hald.

LIMACIDÆ.

ARIONINÆ.

Arion fuscus, Müller.

Occurs rarely in gardens in the city of Portland.

Lingual membrane has 100-31-1-31, central tridentate, base thickened; laterals bidentate merging into uncini which are two or three cuspid.

LIMACINÆ.

Limax campestris, Binney.

Common in woods.

Limax flavus, Linn.

Occurs rarely in Portland.

Limax agrestis, Müller.

Common in fields and by the road side near villages, and abundant in cellars and gardens in Portland.

Buccal plate (*Fig. 1.*) arcuate, ends blunt, cutting edge not produced, exterior surface marked with numerous slight longitudinal ribs which project over the cutting edge.

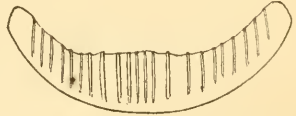


Fig. 1.

Lingual membrane having over 100 rows, 32-1-32; central plate longer than wide, widening posteriorly; central denticle long as plate, strongly shouldered at base; laterals unidentate, strongly shouldered at outer base; uncini bicuspid. (*Pl. 3, Fig. 2.*)

PHILOMYCENIDÆ.

TEBENNOPHORINÆ.

Tebennophorus Carolinensis, Bosc.

Occurs rarely in the southern portions of the State.

Buccal plate (*Fig. 3.*) strongly arcuate, very wide longitudinally, middle of cutting edge bearing a perceptible beak, strongly striate, longitudinally and transversely.

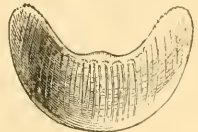


Fig. 3.

Lingual membrane having 115-56-1-56, central plate long and narrow, widening posteriorly, having one denticle half the length of plate; laterals long, narrow, unidentate, merging into bidentate uncini. (*Pl. 3, Fig. 4.*)

Pallifera. NOV. GEN.

Buccal plate arcuate, rounded at sides; having seven prominent ribs, which crenulate its cutting edge.

Lingual membrane has central plate tridentate, laterals bidentate, uncini denticulated.

Pallifera dorsalis, Binney.

Not uncommon.



Fig. 5.

Buccal plate (*Fig. 5.*) stout, arcuate, rounded at sides, having seven distinct longitudinal ribs which deeply notch the cutting edge, central one largest.

Lingual membrane has 118-29-1-29: central plate rather long and narrow, with one long denticle flanked by two small denticles; first ten laterals bidentate, the smaller outer denticle setting off at a slight angle from the base of larger denticle, the remainder of the plates tridentate, those on the extreme border of membrane being wide and short with one or two short denticles. (*Pl. 3, Fig. 6.*)

HELICIDÆ.

HELICINÆ.

Mesodon albolabris, Say.

Appears to be a common species throughout the State, though not found in great numbers inland. On some of the islands in Casco Bay they are met with in great abundance, the representatives of each island showing some peculiarities of growth or color. Mr. C. B. Fuller has detected a beautiful form of this species on one of the outer islands in Casco Bay in company with *Tachea hortensis*. The shell is rather below the average size, quite stout, and deep brown or claret in color, with a broad heavy white lip. On another island not far from this, the species assumed a large light-yellow shell. Mr. Fuller has in his collection a specimen of this species which has become singularly deformed by injuries received before it had attained its complete growth. The last whorl instead of proceeding in its usual course, is turned completely under the shell, is devoid of periostraca, and exhibits frequent attempts at producing a lip. The timidity of the species when first kept in confinement, is exhibited by a quick withdrawal of the tentacles on being touched. It loses its timidity after a while and appears quite tame.

Buccal plate (*Fig. 7.*) heavy, arcuate, not tapering at sides, having ten conspicuous ribs which crenulate the upper and lower edges of plate; lines of accretion distinct.

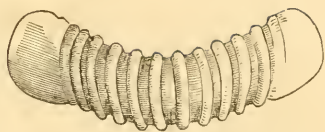


Fig. 7.

Lingual membrane 123-44-1-44, central plate long, widening posteriorly, having one denticle as long as plate; laterals having one long stout denticle merging into bidentate uncini, smaller denticle nearly obsolete. (*Pl. 3, Fig. 8.*)

The whole membrane bears a strong resemblance to that of *Tebennophorus Carolinensis*.

Mesodon Sayii, Binney.

This species has been found in several localities in the State. J. M. Gould found this species in Aroostook Valley. Mountain sides appear to be its most congenial position. One specimen in my collection exhibited the singular process of two perfect lips formed about one fourth of an inch apart.

Buccal plate, (*Fig. 9.*) strongly arcuate, tapering at the sides, having from twelve to thirteen longitudinal ribs which strongly notch the cutting edge, and crenulate also the upper edge.

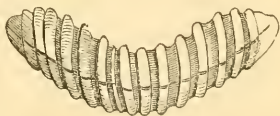


Fig. 9.

Lingual membrane 123-42-1-42, central plate narrow at base of denticle which is longer than plate; laterals long, narrow, and curving inward, having one long broad denticle, merging into uncini which have two long denticles coalescing, extreme uncini tridentate, obtuse. (*Pl. 4, Fig. 10.*)

Mesodon thyroides, Say.

Dr. C. T. Jackson catalogues this species in his Report on the Geology of Maine, and as the shells collected by him were submitted to Dr. A. A. Gould for verification, there can be no doubt of the occurrence of this species in the State.

Triodopsis dentifera, Binney.

A few specimens were discovered by Mr. John M. Gould at Bethel, Maine, on the Androscoggin river; they were found high up on a mountain slope, in young birch, in company with *M. Sayii*.

Pomatia aspersa, Müller.

Dr. Binney mentions the occurrence of this species on the coast of Maine, otherwise than this, I have never heard of its presence in the State.

Tachea hortensis, Müller.

This species has been found in abundance on several islands from Casco Bay to Grand Menan. Mr. Fuller found them on one of the extreme outer islands in Casco Bay in great profusion; the island is covered with a growth of wild dwarf pear, on the branches of which he found great numbers clinging. If this species is really identical with the *Tachea hortensis* of Europe, it seems a little singular that here it should only be found on islands frequently barren and far out from the land, and that the supposed variety *hortensis* only should occur, while in the old country they become a nuisance in gardens.

W. Thomson, in the *Annals and Mag. Nat. His. Second Series*, Vol. 7, gives the dentition of *Tachea nemoralis* thus: number of rows in lingual membrane 135, number of plates in a row 100, total 13,500. We find the following in a full grown specimen of *Tachea hortensis* from Maine: 116 rows, 65 plates in a row, total 7540.

A tracing which Mr. Binney sends me of the buccal plate of the European *T. nemoralis* is nearly identical with the buccal plate of this species, while that of the European *hortensis* is quite different.



Fig. 11.

Buccal plate, (Fig. 11,) strongly arcuate, having five longitudinal ribs which notch both edges of the plate, central rib largest, distinctly striated transversely.

Lingual membrane, 116-32-1-32, central plate widening posteriorly, having one large denticle not as long as plate, first seven laterals unidentate, which gradually merge into irregularly tridentate uncini. (Pl. 4, Fig. 12.)

The numbers on the cut indicate their position from the central: owing to the complicated form of each plate, the entire row is not drawn.

Stenotrema monodon, Rackett.

Found throughout the State, though not a common species. Two or three specimens are generally found together. I have frequently noticed them on trunks of trees four or five feet from the ground. I have also found them in open pastures. In confinement the animal remains within the shell, rarely moving about. The minute hairy projections on the surface of this species

are always constant in all our specimens, though more conspicuous in the young. These projections are colorless and spring from translucent areas, slightly elevated from the surrounding surface, and devoid of the coarse, irregular, and interrupted rugæ which mark the periostraca. (*Plate 2, Fig. 2.*)

Buccal plate, (*Fig. 13.*) saffron color, stout, regularly arcuate, having six or seven longitudinal folds scalloping both edges of the plate.



Fig. 13.

Lingual membrane 100-28-1-28, central plate quite broad having one large blunt denticle; first five or six laterals having one large denticle, next twelve with an incipient outer denticle at the base of larger denticle; uncini irregularly dentated. (*Pl. 4, Fig. 14.*)

Anguispira. NOV. GEN.

This name is proposed for *alternata*, as we cannot include it with *Patula* or *Euryomphalus* if we take *II. rotundata* as the type.

Anguispira alternata, Say.

On some of the islands in Casco Bay this species occurs in the greatest profusion, and though generally distributed throughout the State they are not common. Occurs at Aroostook. Perfectly colorless specimens were found in the hollow of a tree on one of the islands in the bay. The periostraca is very much like that of *Patula striatella*.

Buccal plate, (*Fig. 15.*) arcuate, stout, not wide, of the same length throughout, lateral terminations truncate, strongly striate both longitudinal and transverse.

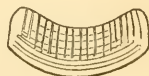


Fig. 15.

Lingual membrane 121-34-1-34, central plate wide, with one large denticle shouldered at its base, barely indicating the trace of a smaller denticle, laterals long, angular, having one long wide denticle with a minute denticle at its outer base, uncini small and square, distinctly bidentate, one denticle minute. (*Pl. 4, Fig. 16.*)

In the lingual membrane of one old specimen which I examined the denticles were worn completely away from the first ten rows of plates.

VITRININÆ.

Vitrina limpida, Gould.

Occurs in the neighborhood of Portland, and on several islands in Casco Bay and vicinity. I met with several specimens at

Bethel, Maine; also found it on the St. John's river at the extreme northern boundary of the State.

Lingual membrane 90-25-1-25. Central plate long, having one long central denticle and two short denticles. Laterals seven, having one long and one short denticle. Uncini bidentate, aculeate, extreme uncini tridentate. (*Pl. 5, Fig. 17.*)

Mr. W. Thomson in *Annals and Mag. Nat. His.* second series, Vol. 7, gives the following formula of *Vitrina pellucida* of England: number of rows 160; number in a row 110; total 17,600. By the above it will be seen that *Vitrina limpida* stands thus: number of rows 90; number in a row 51; total, 4,590.

HELICELLINÆ.

Macrocyclus concava, Say.

Found in several places in Oxford County, though very rare. All the specimens were exceedingly dwarfed. I kept one of this species in confinement with several specimens of *Hyalina cellaria*; these it soon devoured, even destroying the viscera far within the shell; its long cylindrical body being well adapted to facilitate its carnivorous propensities.

I am indebted to the Smithsonian Institution for the use of the cut illustrating the dentition of this species. I solicited the use of it from Prof. Henry in order to complete the dentition of our Maine Helicellinæ.

Hyalina cellaria, Müller.

Occurs rarely in cellars and gardens in the city of Portland. One lady informed me that they troubled her a great deal by crawling into the pans of milk.



Fig. 18.

Buccal plate, (*Fig. 18.*) (*Fig. 19.* young.) crescentic, projecting in the centre, forming a well defined point, slightly striate longitudinally in the centre.



Fig. 19.

Lingual membrane 38-17-1-17; central plate very long and narrow, with three minute teeth occupying nearly the centre of the plate, i. e. midway between anterior and posterior edges. First four laterals irregular in shape, apparently bidentate, uncini long, single, aculeate denticles. (*Pl. 5, Fig. 20.*)

Hyalina indentata, Say.

Widely distributed throughout the State; more numerous in the interior.

Body when fully expanded nearly three times the length of the shell's diameter; very slender; disk white; head, sides and back bluish; tentacles dark blue. Superior tentacles unusually long and thick compared to the size of the body. Very active and bold in confinement.

The indented lines on the surface of the shell appear like deep seams. The lines of accretion are scarcely distinguishable, though close minute revolving lines are apparent. (*Plate 2, Fig. 11.*)

Buccal plate (*Fig. 21.*) slightly arcuate, partially raised in middle of cutting edge, longitudinally striate in centre of plate.



Fig. 21.

Lingual membrane 53-39-1-39; central plate armed with a long and broad denticle, with a smaller pointed denticle on each side; laterals three, long and narrow, slightly curved, having one long broad denticle and one smaller outer denticle; uncini thirty-six, having one long re-curved hook, gradually diminishing to minute plates. (*Pl. 5, Fig. 22.*)

Hyalina electrina, Gould.

Common throughout the State. Appeared to be the most common species in the northern parts of Maine. Faint revolving lines mark the surface of the shell; also slight folds in the peristoma which run obliquely across the incremental lines.

Buccal plate, (*Fig. 23.*) crescentic, wide through the centre, the lateral terminations turning backward; the centre of cutting edge produced into a large rounded beak having on either side one or two smaller projections.



Fig. 23.

Lingual membrane 54-27-1-27. Central plate broad and long, having one long slender denticle and on either side at its base a smaller denticle; laterals three, bidentate, first two long and narrow, third smaller, uncini having one long claw-shaped denticle. (*Fig. 24.*)

Hyalina Binneyana. NOV. SP. (*Fig. 25.*)

Body bluish, disk white, viscera bright orange color. Shell thin, pellucid, nearly colorless; composed of nearly four whorls gradually enlarging; spire slightly elevated, aperture well rounded, umbilicus showing all the volutions. Diameter, .13 inch, axis .07 inch.

Periostraca slightly wrinkled by lines of accretion; numerous short rugæ also run obliquely across the incremental lines. (Plate 2, Fig. 9.)

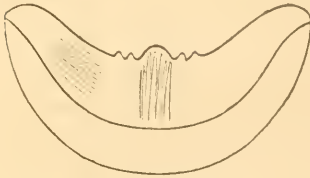


Fig. 26.

Buccal plate, (Fig. 26,) crescentic, produced in the middle of cutting edge, forming a large rounded beak, on each side of which are two smaller projections.

Lingual membrane 60-23-1-23, central plate nearly square, tridentate, central denticle long, slender; laterals three, (Fig. 27, a,) outer posterior portion somewhat pointed, bidentate, larger denticle occupying nearly the centre of plate, smaller denticle close to the outer edge of plate. Third lateral irregular in shape and smaller than first and second laterals. Uncini having long claw-shaped denticles, anterior portions abruptly bent inward. (Pl. 6, Fig. 27.)

This species is nearest allied to *H. electrina*; it differs from that species in the following particulars: it is nearly one third smaller than *H. electrina*, its color is quite different being nearly white with a greenish tinge. The buccal plate is much longer and has a posterior expansion which we do not observe in *H. electrina*; the lateral terminations of buccal plate are somewhat rounded, while in *H. electrina* the same portions are pointed. By comparing the figures of the dentition of the two species several important differences will be noticed; the lateral plates are broader and shorter than in *H. electrina*, the uncini are abruptly bent inward at their anterior portions and the number of plates stands thus: 60-23-1-23, so that we have a less number of plates in a row, but a greater number of rows than we obtain in *H. electrina*. It might often be mistaken for the young of *H. indentata* which it resembles very much in form and color. Has been met with in several portions of the southern parts of the State. The umbilicated variety of *H. indentata* may prove to be this species. We take the liberty of naming this species after W. G. Binney, Esq.

Hyalina arborea, Say.

Found everywhere in abundance.

The incremental striæ on the shell are barely visible, there are also minute close-set revolving lines. The whole surface of the shell appears to be marked with minute dots which do not

appear to be raised but are rather within the substance of the periostraca.

Buccal plate, (*Fig. 28*.) crescentic, tapering to a point at each side, roundly projecting in the centre of cutting edge, and correspondingly depressed on posterior edge.



Fig. 28.

Lingual membrane 82-21-1-21, central plate broad and square, widening posteriorly, tridentate, central denticle longer than plate, laterals four, long, narrow, projecting at outer posterior corner, having one long and one short denticle, uncini simple, long, recurved spines, those nearest laterals having on their outer side a small denticle. (*Pl. 6, Fig. 29.*)

Hyalina multidentata, Binney. (*Fig. 30.*)

A few specimens only have been found in Cumberland and Oxford Counties.

Animal white with a blueish tinge, back mottled with black, eyes scarcely visible.

The periostraca exhibits no traces of longitudinal lines; the lines of accretion are very faint; equidistant furrows radiate from the suture as in *H. indentata*.

Buccal plate, (*Fig. 31*.) crescentic, sides turning slightly back, cutting edge nearly straight, faintly notched.



Fig. 31.

Lingual membrane 68-15-1-15, central plate broad, flaring out posteriorly, tridentate, central denticle longer than plate, side denticles very small; laterals two, similar in shape having one long and one short denticle; uncini, long recurved hooks, first of the uncini more like a modified lateral. (*Pl. 6, Fig. 32.*)

The peculiarities of the shell may form the type of a sub-genus, though I prefer placing it at present with *Hyalina*.

Pseudohyalina. NOV. GEN.

We unite under a distinct generic title the two following species. They are closely connected with *Hyalina* by the aculeate uncini, though the differences seen in the shell, peculiarities in the dentition and buccal plate, I consider to warrant their separation. In *Hyalina* the laterals comprise one-sixth or one-seventh of the whole number of plates in a row, while in *Pseudohyalina* the laterals comprise about one-third the number. In *Hyalina* the shell is smooth and polished; in this the shells are either ribbed

or striated. In *Hyalina*, the buccal plate is crescentic with a central projection, in this the plate is more like those species we include under *Valloninae*. In short this genus is related to *Hyalina* in the characters of the lingual dentition, and to *Valloninae* in the character of the shell and buccal plate.

Pseudohyalina exigua, Stimpson.

Occurring all over the State, and in favorable positions found in abundance; generally preferring low, wet ground, though sometimes living in situations comparatively dry.

The body is quite narrow and long, greenish white, marked with black along the back. The tentacles coarsely blotched with black. The costæ are more numerous on the shell of this species than in *P. asteriscus*, and are also more solid and not so projecting; they run moreover not parallel with the lines of accretion but obliquely across them; the surface of the shell is reticulated by numerous longitudinal lines somewhat waved and nearly as prominent as the costæ, which extend to the apex, which is thus distinguished from the granulated apex of *P. asteriscus*. The space between these longitudinal lines, is marked with minute transverse rugæ extending from one line to the other, though frequently terminating midway between them; these run obliquely across the costæ and parallel with the line of aperture. The whole surface of the shell presents a most beautiful appearance when highly magnified. (*Plate 2, Fig. 8.*)

Lingual membrane, 69-16-1-16, central plate long, having one long slender denticle and two small ones; laterals longer than wide, outer posterior angle projecting, bidentate, larger denticle the length of plate; uncini aculeate, those nearest the laterals having a small denticle on their outer sides. (*Pl. 7, Fig. 33.*)

Pseudohyalina minuscula, Binney.

A few specimens only have been found in the vicinity of Portland. It would seem that this is its extreme eastern limit.



Fig. 34.

Buccal plate, (*Fig. 34.*) nearly straight, rounded at ends, faintly striate longitudinally, slightly raised in centre of cutting edge.

Lingual membrane 53-12-1-12, central plate nearly square, wider at posterior portion, tridentate, laterals bidentate, uncini, nearly straight sharp spines. (*Pl. 7, Fig. 35.*)

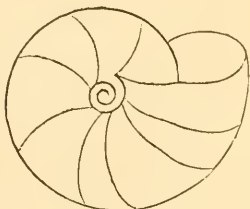
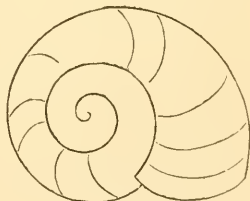
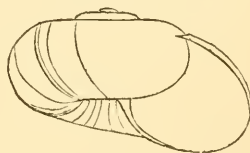
Not being able to get a living specimen of this species to procure the parts above described, I resorted to a specimen received from Cincinnati, Ohio, ten years ago, and by soaking it in water for nearly three hours, the dried remains within the shell were so softened, that with a little diligence and patience I managed to extract the entire lingual membrane and buccal plate. Mention is made of this, that others desirous of securing the dentition of any species of which they have no living example, can, by pursuing the above course obtain satisfactory results from the exsiccated animal.

Striatura. NOV. GEN.

Based upon peculiarities of dentition as seen in the enormous central plate and the channelled buccal lamina.

At first sight these might be regarded as specific peculiarities, considering the size of central plate as one of degree only, but we find the buccal plate modified in such a manner as to conform perfectly to this difference in structure.

The two following species are united under the above name after a careful consideration of these features. I became acquainted with the dentition of *S. milium* before I had discovered the species herein described as *S. ferrea*, and had made up my mind as to the value of these differences. When therefore I discovered the latter species, I noticed in the appearance of the shell alone its strong specific weight. But still the close similitude it bore to the shell of *S. milium* lent it a new interest; and on examining the lingual membrane and buccal plate its generic affinities with *S. milium* were rendered complete.



(Fig's 36, 37, 38.)

Striatura ferrea, NOV. SP.

(Fig's 36, 37, 38.)

Animal dark blue, foot rapidly narrowing to an acute point behind. Shell very small, translucent, with a steel grey tinge, not shining: having three volutions, the outer whorl rapidly enlarging, aperture

well rounded, very large, spire slightly elevated. Suture distinct, and deeply channeled near the apex. Umbilicus small, though abrupt, and exhibiting all the volutions. Diameter .10 inch, axis .05 inch. Periostraca minutely marked with fine revolving lines, and lines of increase, which reticulate the whole surface. (*Plate 2, Fig. 10.*)

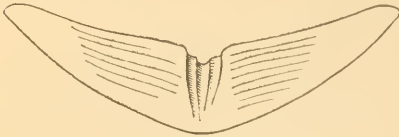


Fig. 39.

Buccal plate, (*Fig. 39.*) slightly bent, tapering at sides; deeply channeled and indented in middle of cutting edge.

Lingual membrane 39-20-1-20, central plate enormous, equal in size to two laterals, nearly twice as broad as long, outer posterior corners projecting outward and backward, central denticle longer than plate, very thick, smaller denticle on each side at base of central denticle, laterals two, bidentate, first lateral small, broader than long, very irregular in shape, having at its posterior portion a slight transverse projection, denticles small; central lateral longer than broad, with one long and one short denticle, uncini aculeate. (*Plate 7, Fig. 40.*)

It resembles the young of *Hyalina indentata* very much, and for a long time I have mistaken it for the young of that shell. Rev. E. C. Bolles frequently called my attention to it, as he could not with propriety refer it to *H. indentata*. On subjecting a specimen to the microscope, its specific value was at once apparent in the marking of the periostraca, which in *H. indentata* is perfectly smooth, exhibiting only the faintest revolving lines; *H. ferrea* lacks also the impressed radiating lines so characteristic of *H. indentata*. The apex is marked with distinct revolving lines, the open umbilicus is constant, and it is not half as large as an adult *indentata*; finally the dead color alone is sufficient to distinguish it from the latter shell. Found in damp localities.

Striatura milium, Morse. (*Fig. 41.*)

Appears to be generally distributed throughout the State, and occurs also in several places in Massachusetts. Though met with in almost every place, where the smaller species of pulmonates are sought, but one or two specimens are ever found at a time; this

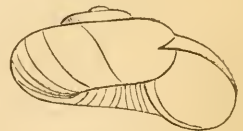


Fig. 41.

scarcity of individuals appears more marked, when specimens of other species are frequently met with in abundance. This species occurs in nearly all positions even in growths composed almost exclusively of pine, spruce and hemlock.

The animal is white, the head and tentacles faintly marked with dark spots.

The surface of the shell is raised in numerous costal folds, frequently anastomosing; longitudinal ribs reticulate the surface and render the folds so crenulated that in certain lights the shell appears as if ornamented with strings of beads. This peculiar character disappears at the base of shell, and is replaced by revolving lines and regular lines of accretion. (*Plate 2, Fig. 7.*)

Buccal plate, (*Fig. 42.*) a long narrow slightly curved lamina, middle of cutting edge indented as in *S. ferrea*.

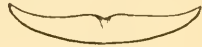


Fig. 42.

Lingual membrane 68-17-1-17, central plate twice as broad as long, equal in size to two laterals, tridentate, central denticle very thick, nearly twice as long as plate, side denticles stout; laterals two, similar in shape, bidentate, denticles small, uncini long claw shaped, first five uncini having a small denticle on the outer side of long one. (*Pl. 7, Fig. 43.*)

Conulus chersina, Say.

Occurring from the northern to the southern confines of the State. At Fort Kent on the extreme northern boundary I found very large specimens of this species.

The inferior tentacles are quite long and slender. A few indistinct lines of growth are visible on the shell, and also numerous revolving lines which are more distinct at the base of shell; near the suture the periostraca is marked with very short minute wrinkles which are scarcely visible even when magnified four hundred diameters. (*Plate 2, Fig. 4.*)

Buccal plate, (*Fig. 44.*) a broad wide crescentic lamina, with the cutting edge raised in the centre, forming a rounded beak.



Fig. 44.

Lingual membrane 80-18-1-18, central plate nearly square, tridentate, central denticle long, slender; side denticles very small, laterals seven, merging into uncini, bidentate similar in form to central; uncini bicuspid. (*Pl. 7, Fig. 45.*)

The strong resemblance between *Conulus chersina* and *Conulus fulva* of Europe has been often remarked by American writers, yet we are not aware that these species have ever been united by any of them. The European writers Chemnitz, Pfeiffer, Reeve, Forbes and Hanley unite the two. With the unaided eye it would be difficult to point out the distinctions between the two species which become apparent when magnified. *Fig. 46* represents an enlarged view of *Conulus chersina* and *Fig. 47* of *Conulus fulva*.



Fig. 46.



Fig. 47.

In *C. chersina* the shell is much more inflated, the spire is more elevated, the whorls are more bulging, and the body whorl is not so angular as in *C. fulva*; the base also of *C. chersina* is more convex than that of *C. fulva*, the form of the apertures of the two species are quite unlike as will be seen by reference to the figures. In the specimens of *Conulus fulva* which I examined there appeared to be a minute umbilicus which is wanting in *C. chersina*. The exterior surfaces of the two species under a high magnifying power show marked differences. Magnified four hundred diameters the incremental lines in *C. fulva* are seen very strongly marked near the suture only; in *C. chersina* these lines are close set and equidistant; in *C. fulva* they are finer and are interspersed between larger waves of the periostraca, they are slightly irregular also. In the same region in *C. chersina* we find minute short longitudinal rugæ which we failed to notice in *C. fulva*. In the umbilical region in *C. chersina* the periostraca appears to be waved, a similar structure is more conspicuous in *C. fulva*. The chief peculiarity in *C. chersina* which we have not seen mentioned before in relation to this species, is the close set revolving lines, (*Plate 2, Fig. 4,*) which are so delicate they can hardly be discerned even when highly magnified. These lines are more conspicuous in the umbilical region. I have found no trace of this peculiar feature in *C. fulva*.

Thomson, in the paper above referred to, gives the dentition of *Conulus fulva* thus: 70 rows of plates, with 45 plates in a row,

total 3,150. *Conulus chersina* stands thus: 80 rows of plates 37 plates in a row, total 2,960; thus we have the palatal membrane longer and narrower in *C. chersina*.

VALLONINÆ.

***Patula striatella*, Anthony.**

Abundant everywhere throughout the State; I have frequently met with specimens perfectly white. I have received from Rev. E. C. Bolles of Portland a distinct variety of this species collected by him at Waterville, Maine; they were rather above the average size, the whorls bulging, the usual semi-carination being entirely obsolete, the suture very deeply impressed. In one specimen the last whorl is completely separated from the shell and turns rapidly downward in its revolution. The regular folds or ribs which characterize this species are quite prominent and sharp; between these ribs the periostraca is marked with irregular rugæ, which run not only parallel with the ribs but across in every direction, and appear to be governed by no order of arrangement, appearing more like cracks caused by a change in the condition of the periostraca; very fine revolving lines are also observable. (*Pl. 2, Fig. 6.*)

Buccal plate (*Fig. 48.*) arcuate, pointed at sides. marked with diverging striæ, cutting edge unevenly notched or jagged.

*Fig. 48*

Lingual membrane 100-16-1-16, central plate largest, square tridentate, laterals nearly square, bidentate, uncini with two minute denticles. (*Pl. 8, Fig. 49.*)

***Vallonia minuta*, Say. (*Figs. 54, 55.*)**

Found everywhere in abundance throughout the State. In gardens in the City of Portland.

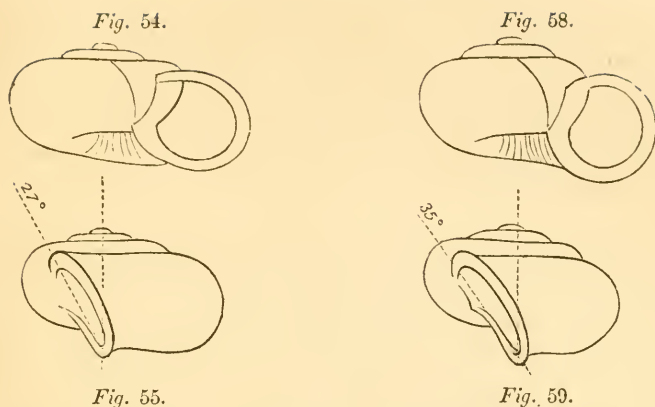
Buccal plate, (*Fig. 56.*) wide, narrow, straight, lateral portions slightly bent, longitudinally striate, cutting edge minutely notched.

*Fig. 56.*

Lingual membrane, 73-11-1-11, central plate narrow, notched at outer posterior angles, having three minute denticles; laterals, three, lozenge shaped, bidentate, outer posterior angle indented; uncini broad, short, denticulated, (*Pl. 8, Fig. 57.*)

This is one of the first species described by Say. He was probably unacquainted at that time with the *Vallonia pulchella* of Europe, as he makes no remarks on the resemblance of his species with the European form. Stimpson, Kirtland and Dekay retain the specific name of *minuta* for this shell, while Binney, Gould, W. G. Binney, Adams, Mighels, and all the European writers unite it with *V. pulchella*. Dr. Binney expressed his opinion that this species was not identical with *V. pulchella*, as he could not perceive how an introduced species could have penetrated regions so remote from the coast. (Binney's Mon., Vol. II. p. 176.) W. G. Binney has in his possession notes of Mr. Say never published, in which he (Say) acknowledged an identity between the two species. When we consider how widely and abundantly this species is distributed throughout North America, no less abundant in the far west than on the Atlantic coast, we certainly have reason for believing this species indigenous. The occurrence of the supposed variety, *V. costata* in this country has been cited as an evidence of the identity of *V. minuta* with *V. pulchella*. I cannot see that the occurrence of this ribbed variety in the United States proves any identity between the two species, for it seems probable that two species so intimately resembling each other would be liable to exhibit similar modifications; examples are common wherein closely related forms present similar phenomena of variation; among the *Helicidæ* for instance, we have the difference in the coloring both of the animal and shell, the presence or absence, or the variability in the arrangement of teeth within the aperture of the shell, the closed or open umbilicus; or, among the *Unionidæ* we have in close resembling species an identical mode of variation, either in the inflation or contraction of the shell, in the elongation or truncation of the anterior region, or, in the presence or absence of radiating lines of coloring. *Vallonia costata* however, I believe to be a distinct species.

In the following comparisons numerous specimens from various localities in Europe, and from Ohio, New York, Massachusetts, and Maine, have been examined and the differences pointed out have been verified in every specimen examined.



Figures 54 and 55 represent a specimen of *Vallonia minuta* from Portland, Maine, Figures 58 and 59 represent a specimen of *Vallonia pulchella* from Tuscany. The principal points of difference will be seen in the more depressed form of *V. minuta* as compared with *V. pulchella*, the whorls are not as large, the labrum as it joins the labium near the umbilicus is more directly under the body whorl than in *V. pulchella*; the upper part of the aperture is not so arching as in the European shell, and the entire aperture, modified by these differences, is not so completely circular as in *V. pulchella*, while the lower portion of the last whorl in the European shell is slightly flattened; in *V. minuta* the outline forms a perfect curve. The principal points of difference between the two species is seen in the angle formed by the dotted lines in Figures 55 and 59, one of which passes through the axis of the shell, and the other parallel with the plane of the aperture; the line perpendicular to the axis of the shell in relation to the plane of the aperture, forms a greater angle in *V. pulchella*. This we consider a very marked and important distinction between the two species. *V. minuta* is generally more translucent; the periostraca of the two shells when highly magnified exhibit slight differences also.

W. Thomson of England gives the dentition of *V. pulchella* thus, number of rows 65, number of plates in a row 30, total, 1950. We find *V. minuta* to stand thus, number of rows 73, number of plates in a row 23, total, 1679.

The following outline represents the buccal plate of *V. pulchella*, (Fig. 60, from Moquin Tandon,) this differs considerably from *V. minuta*, for in the last named species we have a broad narrow plate with the cutting edge not elevated or produced in the centre as in *V. pulchella*, but straight and finely notched by the perpendicular striae.

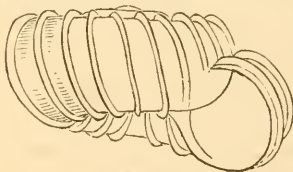


(Fig. 60.)

The three following species differ so greatly from each other in the shell, lingual dentition, buccal plate, and proportion and form of the extended animal, that I consider it a less violation of their natural characters to separate them under distinct generic names, than to unite them under one common title. In *Helicodiscus* (nov. gen.) we have a peculiar structure of the shell, buccal plate, dentition, and form of the head. In *Planogyra* (nov. gen.) we have again certain differences in the shell, buccal plate and dentition, which make it distinct from all other genera herein described. The habits of the species forming this genus are nearly aquatic. In *Strobila* (nov. gen.) we see such profound differences in the shell combined with other peculiarities, that we are forced to place this species also under a distinct generic title.

Planogyra asteriscus, Morse. (Fig. 50.)

This species first discovered at Bethel, Maine, has since been found at Gorham, Maine, and on the Kennebec River, also at Salem, Mass., on the Hudson River, N. Y., and at Gaspé, Canada East. I. A. Lapham has it also from the northern shores of Lake Superior; it seems by this to be widely distributed; it must however be regarded as



(Fig. 50.)

a species of rare occurrence. In the only two places where I have found them, the ground was very wet and boggy; they occurred abundantly however, and the intermixture of coniferous trees appear to produce no disturbance to their perpetuation and increase. The animal is very translucent, body bluish white, head, neck and tentacles mottled with bluish black in streaks and dots; disk yellowish white. (Fig. 51.) The shell



Fig. 51.

is banded with twenty to twenty-five thin, sharp, prominent laminae, inclined slightly backward and parallel with the lines of accretion; these laminae present a waved appearance on their outer edges, probably produced artificially as they are very elastic. Between these ribs are distinctly seen the incremental lines; revolving with the whorls are also interrupted lines, these are intercostal only. (*Pl. 2, Fig. 5.*)

Buccal plate, (*Fig. 52.*) slightly arcuate, rounded at sides, irregularly wrinkled longitudinally; cutting edge produced in the middle to a rounded beak.



Fig. 52.

Lingual membrane 77-13-1-13, central plate long, quite narrow, outer posterior angles projecting, having three small denticles. Laterals nearly lozenge shaped, outer posterior angle with two projections; having one large denticle, one smaller outer denticle, and at the inner base of large denticle a minute projection. Uncini broad and short, with one or two minute denticles. (*Pl. 8, Fig. 53.*)

The remarks of Dr. Gould, quoted by W. G. Binney, in his "supplement," in connection with this species, were not intended for this shell. Several years ago I sent a description with specimens of *Punctum minutissimum* to the Boston Society of Natural History, under the supposition that it was new, having never seen Lea's description, and Dr. Gould's remarks were in reference to those specimens.

Helicodiscus lineata, Say. (*Fig. 61.*)

Everywhere in company with the smaller species, though nowhere abundant.

Animal nearly white or rather translucent, mottled with small white blotches, body long and narrow, upper posterior portion of foot conspicuously furrowed. In motion the shell lies perfectly flat on the extreme posterior portion of body, the superior tentacles standing nearly perpendicularly, and the head with inferior tentacles thrust out some way beyond the base of larger tentacles; eyes scarcely visible. From fourteen to fifteen ribs ornament the shell of this species, between which are

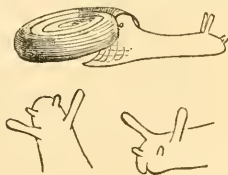


Fig. 61.

seen still finer revolving ribs; incremental striæ irregular and extending over the ribs are also present. (*Plate 2, Fig. 3.*)



Fig. 62.

Buccal plate, (*Fig. 62.*) curved, tapering laterally from the centre, striæ radiating from centre of cutting edge, which is slightly projecting.

Lingual membrane, 77-12-1-12. Lateral plate long, narrow, with a projection at its outer posterior angles, tridentate, denticles minute, laterals nearly square, outer posterior side thickened and produced, having one long denticle occupying the centre of plate, with a smaller denticle occupying each side, at its base, uncini denticulated, those nearest laterals having three or four rounded denticles. (*Pl. 8, Fig. 63.*)

***Strobila labyrinthica.* (*Fig. 64.*)**

Occurs throughout the state, in some places in abundance. White specimens of this species have been observed. Animal

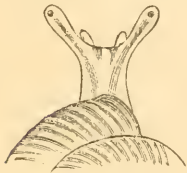


Fig. 64.

quite small compared to the size of the shell, superior tentacles thick, bulbous, head broad, eyes very large. The upper portion of the whorls of the shell is deeply ribbed, (*Plate 2, Fig. 12, a.*) while the lower portion or base of the shell is very lightly ribbed and marked with arborescent rugæ. (*Plate 2, Fig. 12. b.*)

The shell of this species has always been described as having one revolving tooth within the aperture, and sometimes a second one terminating farther within the aperture. I have always found this second one constant, and also a *third* one but slightly raised between these two.

At the base of the shell and far within the aperture are two more revolving ribs, running about a third of one volution. These are plainly visible through the substance of the shell. A heavy columellar tooth or rib extends from a slight distance within the aperture, nearly one volution back. This columellar tooth thickens the substance of the shell in the umbilical region and causes a distinct fold without the shell. (*Fig. 65.*)

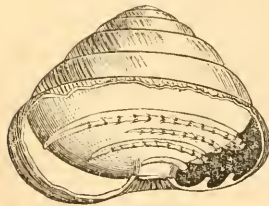


Fig. 65.

A most singular feature is revealed in the structure of the

parietal laminae. With an ordinary magnifying power, small swellings are seen at close intervals along these laminae, which when magnified four hundred diameters are seen to be surmounted with from five to ten sharp spines pointing toward the aperture:

(*Fig. 66.*) These swellings appear to coincide in number and position with the raised ribs without the shell, though they are not formed at the same time; for as these laminae approach the aperture they become attenuated and disappear.

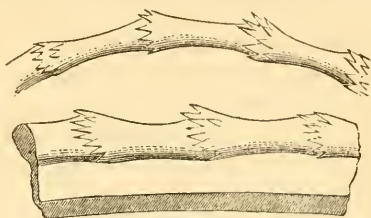
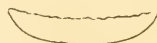


Fig. 66.

The surface upon which these laminae rest is granulated, and not smooth as is generally the case with the interior of shells. It is difficult to imagine the use of these spiny projections, unless they may act in some way as points of resistance to the animal for the support of a very heavy shell.

Buccal plate, (*Fig. 67.*) slightly arcuate, cutting edge straight, minutely notched.



Lingual membrane, 78-13-1-13, central plate large, square, tridentate, central denticle long as plate; Laterals square, outer posterior margin raised into a tooth-like projection, bidentate; uncini broad, short, denticulated. (*Pl. 8, Fig. 68.*)

Fig. 67.

PUNCTINÆ.

Punctum. NOV. GEN.

From the peculiar conformation of the buccal plate, divided into sixteen distinct pieces, and the character of the lingual dentition corresponding closely with *Carychium exiguum* and not unlike *Alexia myosotis*. I am not only inclined to propose a new genus for this species, but to raise it also to the importance of a sub-family, trusting that a more extended examination of its habits and structure will sustain me in this step.

Punctum minutissimum, Lea. (*Fig. 69.*)

Abundant throughout the southern portions of the State. Their extreme minuteness renders them difficult of detection; in one

locality where they were numerous, I counted eighty-three specimens on a single small leaf. Dense hard wood growths appear to be their favorite position. They prefer the rotten bark of beech trees, and frequently are found in the large forms of fungi, such as *Polyporus* and *Boletus*. The periostraca is raised in coarse ridges running parallel with the incremental striæ; these ridges become more prominent as they approach the umbilical region; they frequently coalesce at, or near the suture; the faintest perceptible revolving lines are also present, which become more prominent near the umbilicus, and seem to be arranged in pairs. (*Plate 2, Fig. 1.*)

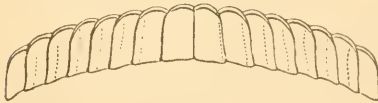


Fig. 70.

Palatal membrane, 54-13-1-13. Plates long and narrow, becoming narrower as they approach the sides of the membrane. Plates transparent, denticles light horn color, central plate largest with one small rounded denticle, laterals with two equally short rounded denticles, those on the verge of the membrane having three minute denticles, laterals and uncini not distinguishable. (*Pl. 8, Fig. 71.*)

This species described by Lea over twenty years ago, has until recently eluded detection; it has an extended distribution in this country, having been found in Ohio, New York, Massachusetts, and in nearly every portion of Maine. It is very common in the vicinity of Cambridge, Mass. Its extreme minuteness has proba-



Fig. 69.

Figure 69 represents a specimen of *Punctum minutissimum* from Bethel, Maine, and figure 72 a specimen of *P. pygmæa*, from Florence, Italy. Our shell never attains the size of *P. pygmæa* and the suture is nearer the centre of the body whorl.

Fig. 72.

The spire is more elevated and the whorls revolve more closely in our shell. The two shells highly magnified exhibit faint revolving lines, which in *P. pygmæa* are more dis-

The buccal plate, (*Fig. 70.*) is made up of sixteen long slender corneous laminae, recurved at their cutting edges, these plates partially lapping over each other.

tinct and not so closely arranged. The striæ are very marked and prominent in both species; in *P. pygmæa* however they are wider apart and more regularly disposed.

I can see no resemblance between this shell and *S. labyrinthica* which Lea mentions, though it resembles somewhat the young of the latter species viewed from the apex. A magnified view bears more resemblance to *Helix solitaria*. Since writing the above I have had an opportunity of examining Moquin Tandon, and find the jaw of *P. pygmæa* as figured by him generically distinct.

SUCCININÆ.

Succinea Totteniana, Lea.

Abundant in all parts of the State, in fields and in woods: have met with it in numbers in the middle of roads, and on railway tracks in the early part of the day. In a visit to Aroostook we met with this species at all the landings on Penobscot River, and at all places on the route to Fort Kent, where we found it in abundance.

Buccal plate, (*Fig. 73*.) strongly areuate, maroon color, cutting edge having three folds. Attached to the convex margin is a large quadrangular piece extending posteriorly, allowing a greater support for the attachment of muscles which move the plate.

Lingual membrane, 100-33-1-33. Plates long, narrow, sides parallel, central plate tridentate, middle denticle long, slender, laterals bidentate, similar in shape to central, uncini tridentate, denticles short. (*Pl. 9, Fig. 74.*)

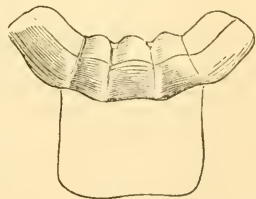


Fig. 73.

Succinea avara, Say.

Not a common species, but when met with, generally found in plenty.

Buccal plate, (*Fig. 75*.) broad, narrow, strongly arcuate, having one central projection on its cutting edge, and a slight depression on its inferior edge.

Lingual membrane having thirty-nine plates in a row, central plate broad, square, having one long and two short denticles, laterals seven, longer than broad, angular,

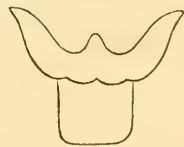


Fig. 75.

bidentate, inner side of larger denticle shouldered, uncini denticulated. (*Pl. 9, Fig. 76.*) The entire character of dentition in this species resembles that of the Valloniæ.

Succinea ovalis, Gould.

Generally diffused throughout the State, though not common. Found on "lily pads" in ponds, and on bits of wood along their margin.

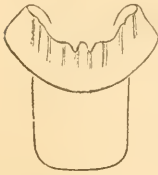


Fig. 77.

Buccal plate, (*Fig. 77.*) similar in shape to that of *S. Totteniana*, the folds on the cutting edge are much smaller.

Lingual membrane 80-40-1-40. Plates all long and slender, lateral plates inclined outward, notched at their posterior edges, central plate tridentate, denticles very small, laterals bidentate, one large and one small denticle, uncini tridentate, extreme uncini unidentate. (*Pl. 9, Fig. 78.*)

Heart pulsates eighty times per minute.

PUPADÆ.

Zua lubricoidea, Stimpson. (*Fig. 79.*)

Common to the State. Found oftener near the coast.



Fig. 81.

Buccal plate, (*Fig. 81.*) slightly arcuate, tapering to a point laterally, the cutting edge produced in the centre to an obtuse beak; longitudinal striæ conspicuous.

Lingual membrane 90-21-1-21, central plate long, very narrow, with a minute central tooth, with traces of a denticle at each side of its base. Laterals square, bidentate, first denticle wide and strong, as long as plate, second denticle short, obtuse; first seven uncini tridentate, inner denticle prominent; the rest short wide plates, denticulated, two extreme uncini plain. (*Pl. 10, Fig. 82.*)

The American species has been unhesitatingly referred to *Zua lubrica*, by all European and American writers, with the exception of Wm. Stimpson, who mentions it in his Synonymy of New England shells under a different specific title, that of *Bulimus lubricoides*, deeming it impossible that an introduced species could have spread so generally over this continent. An attentive examination and comparison of many specimens from several different localities in Europe, and from Ohio, New York, Massachusetts,

many places in Maine, and also from Anticosti, has not as yet brought to light any satisfactory characters by which to distinguish this species from its European representative. I offer a few differences which seemed to hold good in a majority of cases, with the hope that it may stimulate others to continue these investigations, believing that with extensive suites of individuals from both continents, certain marked and constant characters will be discovered between the two species, which will plainly indicate their non-identity, laying aside all geographical considerations.

The two figures here given, represent the apertures of an American and an European specimen. The majority of American specimens examined, resembled figure 79, and the majority of European specimens examined, resembled figure

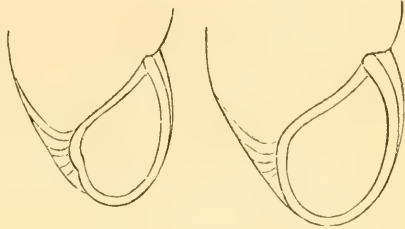


Fig. 80.

Fig. 79.

80. Our specimens in nearly all cases were larger, possessing one more whorl; the color of the foreign specimens was different and darker than ours; the European specimens were more solid and opaque, while ours were lighter in texture and more translucent; the form of the aperture as seen by the figures is broader in the American specimen, from the bulging out of the lower portion of the labrum, and by the labrum curving out more at the suture. The columella which is quite parallel with the axis in the American shell, is slightly oblique in the European species. Mr. W. Thomson in a paper on the dentition of British Pulmonifera, (*Annals and Magazine of Natural History*, second series, Vol. 7,) gives a drawing of the central and first lateral plate of *Zua lubrica*, with the number of rows, and the number of plates in a row composing the palatal membrane, thus, 80 rows, 40 in a row, total 3200. An American specimen examined had 90 rows, with 43 in a row, total 3870. Figure 83 represents a fac simile of his drawing of central and lateral plate of *Zua lubrica*. Figure 84 represents the same plates of *Zua lubricoidea*. We do

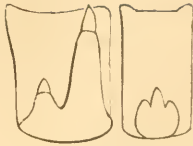


Fig. 84.

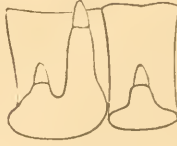


Fig. 83.

not however give these characters as distinguishing features between the two species, believing that a faithful examination of the soft parts will reveal certain specific differences which may then be recognized in the shells.

PUPINÆ.

Zoögenetes. NOV. GEN.

Based upon its ovoviviparous character, the crenulated disk, the prominent labial palpi, and the turreted, costulated, nearly corneous shell. The species *harpa* on which this genus is based, is placed in the sub-genus *Acanthinula* of Beck by Albers. The two European species *H. lamellata* and *H. aculeata* included in *Acanthinula*, are both much smaller than *Z. harpa*. *A. lamellata* bears no resemblance to *harpa*, and though *aculeata* is more like *harpa*, yet the enlarged outline of the head of *aculeata*, as given by Moquin Tandon, a fac-simile of which is here presented, is quite



dissimilar to the same portion in *Z. harpa*. Moquin Tandon does not even show the labial palpi in his drawing, though he thus speaks of the palpi and tentacles. "*Tentacula inferiora et palpi labiales sat magna.*"

In *Z. harpa* the inferior tentacles are nearly obsolete, and as no mention is made of the borders of the disk being crenulated, and of the ovoviviparous character, I must regard *Zoögenetes* as a distinct genus from *Acanthinula*.

Zoögenites harpa, Say. (Plate 1, Fig. 1, 2, 3.)

This singular species is very common in the vicinity of Portland. I have also found a few specimens at Bethel, on the Androscoggin River, at Waterville, on the Kennebec River, and at Berlin Falls, N. H. It is a very hardy species, as will be seen by the following data furnished me by John M. Gould, Esq.

“Ground frozen and snow, April 5th, 1858. Found *Bulimus harpa* in their usual abundant quantities. They appeared to be in their winter quarters, having the epiphragm formed, some being glued to leaves; they were but just below the surface, or secreted in acorn cups or nut shells, and I should think from this that they were more hardy than *Bulimus lubricus*, of which I found only two specimens, and these were at greater depths and attached to roots of weeds.”

It is equally proof against heat, for I have found it during severe droughts, adhering to the underside of leaves which were dried to a crisp, while all other species had sought shelter deep in the damp mould.

The following is a description of mine, which is already published in Binney's "Supplement" to his father's work.

“Animal small compared to the size of the shell, body and head slate color; superior tentacles darker, short, thick, bulbous; eyes large, distinct; foot but two thirds length of shell, whitish.

“In motion they are exceedingly graceful, at times poising their beautiful shell high above their body, and twirling it around, not unlike the *Physa*, again hugging their pretty harp close to their body, the shell when in this last position continually oscillates as if the animal could not balance it; it rarely ever moves in a straight line, but is always turning and whisking about, and this is done at times very quickly and abruptly.”

This description I drew from the species in its place of abode, without the aid of any magnifying power. The foot is quite as long as the shell, and not two thirds the length as stated in the above description. The shell is very light and elastic; the costulations, or ribs are thin, colorless laminae, slightly inclined backward; the incremental lines are coarse and irregular; no longitudinal lines were visible, even when highly magnified; the body, disk, and mantle, are marked with white dots, the edge of the mantle is of the same color as the head and tentacles. The disk is rounded posteriorly, broad and truncated anteriorly, the lateral borders of which are deeply crenulated. The head is separate from the disk as in the *Pupadæ*, bearing two minutely crenulated lappets, which hang down on either side of the mouth like a visor, reminding one of the oblique folds on the head of *Glandina truncata*, which we believe to be homologous to them. A longitudinal furrow extends from the mouth downward. The body is so translucent that when extended the ganglionic centres can be plainly seen.

An anatomical examination of individuals of this species, collected on the 12th of September, revealed the fact that it was ovoviviparous; but owing to the minuteness of the object, the constant difficulty in dissecting these animals whose organs are so interwoven, together with the extreme tenuity of its tissues, and my inexperience in operating, I am unable to present more than a general sketch of its anatomy. What is given however, I verified by the dissection of numerous individuals, and its ovoviviparous character is placed beyond doubt.

The ovary, which in those species of terrestrial mollusks examined by Dr. Leidy, were semi-elliptic and slightly curved, in this species is a globular, mulberry shaped mass, intimately adhering to the summit of the oviduct, (*Plate 1, Fig. 4.*) each spherical lobe of the ovary, being composed of minute cells. The oviduct being distended with the embryos did not present that sacculated appearance described by Dr. Leidy in other species. The surface of the oviduct was marked by numerous minute and irregular black lines.

Of more than twenty specimens examined, all contained embryos in various stages of development, none contained more than four embryos, while many contained but two. The eggs appeared to be nearly all of the same size; in the one nearest the ovary the embryo was very active, and by means of cilia moved back and forth in its envelope; it seemed to be composed of a disk surmounted by a mass of aggregated cells, no trace of a shell being visible. In the next embryo the shell (composed of nearly one whorl) was completely formed, showing the lines of accretion distinctly, the mass of larger cells being enclosed by the shell, and showing through in the region of the pulmonary cavity. In this embryo I found the sub-œsophageal ganglia, with the auditory vesicles, (*Plate 1, Fig. 8.*) confirming what has hitherto been stated regarding the embryological development of the Pneumobranchiata, that these are first formed of the internal organs; they differ greatly in form from the same ganglia in the adult. (*Pl. 1, Fig. 5.*) I found no traces of commissures or branches in this. The otoconites (*Pl. 1, Fig. 9.*) were generally oval in shape, numbering from fourteen to seventeen in each capsule. A most sin-

gular spectacle is revealed in watching the tremulous movements of these otoconites, continually crowding toward a common center, not one being displaced, though, when the agitation finally ceases, they become scattered along the walls of their enclosure.

In the third embryo, the ocular dots were distinctly visible, the mantle protruded over the edge of the shell which had attained the growth of one whorl and a half. In this the lingual membrane was formed, though the whole mass of the animal seemed to be nothing but cells of various sizes; the lingual membrane contained only twenty-seven rows of plates, each row having nine plates. (*Plate 1, Fig. 12.*)

In the most matured embryo, the shell had attained the growth of two volutions; the superior tentacles were conspicuous, and the crenulations of the disk distinctly marked. The lingual membrane in this had seventy rows of plates, with nineteen plates in a row. (*Plate 1, Fig. 11.*)

These embryos seemed to fill the upper portion of the parent shell completely, and when born were as large as the aperture of the adult shell. Several of these embryos were placed in a watch glass filled with water to facilitate examinations; after being in this condition, submerged for nearly thirty hours, I found them to be still alive, as their hearts could be easily seen pulsating about forty times per minute, and the body when irritated with the point of a needle speedily contracted.

The general anatomy of this species appears to differ in no respect from allied species described by Leidy. The ganglionic masses, (*Plate 1, Fig. 5.*) differ somewhat in their respective sizes from those figured by Leidy, in Binney's Monograph, Vol. 1. The auditory capsules were quite large, and the otoconites vibrated a long while after the ganglia had been removed from the animal. The supra-oesophageal and sub-oesophageal ganglia, appeared to be connected by a single commissure on each side.

The glottidium, or buccal body is an oval shaped solid muscular organ, forming the anterior portion of a very long oesophagus.

The buccal plate is a wide, arcuated lamina, transversely and longitudinally striate, corneous in texture, and inserted just within the upper lip, its cutting

edge is slightly indented at short intervals, the middle of this edge is roundly projecting. (*Pl. 1, Fig. 13.*)

The lingual membrane, (*Pl. 1, Fig. 10,*) is usually long, having one hundred and twenty rows of plates, each row being composed of thirty-five plates, 17-1-17, central plate nearly square, tridentate, central denticle shorter than plate, and slender, side denticles minute, laterals six, bidentate, merging into denticulated uncini.

Leucochila pentodon, Say.

In all parts of the State, but not common. Found in very wet places.



Fig. 85.

Buccal plate, (*Fig. 85,*) slightly arcuate, of the same length throughout, sides blunt, irregularly wrinkled longitudinally, cutting edge straight, minutely notched.

Lingual membrane, 6+10-1-10, central plate very narrow, notched at outer posterior corners, having three minute denticles, laterals square, notched at outer posterior corner, having one long stout denticle, and one smaller, uncini denticulated, inner denticle prominent. (*Pl. 10, Fig. 86.*)

Leucochila contracta, Say.

Found abundantly in a grove of beech at Bethel, Maine, and has been met with in several places throughout the southern portions of the State. Rare.

Leucochila corticaria, Say.

Occurs rarely at Bethel, Maine, and abundantly at Gorham, Maine, where I found them on the upright trunk of a dead beech, in the interstices of the bark, from its base to a distance of twenty feet from the ground, in company with *I. Gouldii*. In confinement they are quite active, and afford every facility for observation. Body as long as the shell; head, back, and tentacles, smoky or claret colored, posterior portion bluish; disk white, tail unevenly rounded, body coarsely granulated by the largeness of the mucous glands; superior tentacles long and slender, eyes at the tip, very large and conspicuous; inferior tentacles short and obtuse.



Fig. 87.

Buccal plate, (*Fig. 87,*) slightly arcuate, tapering at the sides, cutting edge very slightly elevated in the centre, and longitudinally striate in the middle of plate.

A portion of the lingual membrane had about twenty rows of plates, with 12-1-12, central plate long and narrow, with three minute denticles; laterals nearly square, their outer posterior edges indented, having one long inner denticle the length of plate, and smaller outer denticle. Uncini as in all these species, gradually differing from laterals, marked with four or five minute denticles, inner one prominent. (*Pl. 10, Fig. 88.*)

Pupilla badia, Adams. (*Fig. 89.*) page 38.

Found under stones and in the grass in open fields, and along the road sides near the sea, in the vicinity of Portland. It has never been found inland in this State.

Near Fort Preble in Portland Harbor, over twelve hundred specimens of this species were collected in an hour, the situation was within a rod of high water mark.

Occurs at Anticosti, and the Mingan Islands Gulf of St. Lawrence. (*Verrill.*)

Coarse interrupted wrinkles mark the periostraca; apex granulated; in most adult specimens the periostraca is entirely effaced from the apex. This species is ovoviviparous, having been found with fully developed young in November. Three or four embryos only were detected in each specimen.

The allied European species is also ovoviviparous. (*Moquin Tandon.*)

Buccal plate, (*Fig. 91.*) slightly curved, cutting edge waved.



Fig. 91.

Lingual membrane, 90-14-1-14, central plate longer than broad, tridentate; laterals bidentate, also slightly shouldered on the inner side at the base of larger denticle; uncini denticulated, inner denticle largest. (*Pl. 10, Fig. 92.*)

Though I have examined hundreds of specimens of this species collected in the vicinity of Portland, Maine, I have never been able to find a trace of the parietal tooth which Adams mentions in his description of *P. badia*, and which is represented in the drawings of this species; specimens of this species collected by Mr. A. E. Verrill, from Anticosti and the Mingan Islands, were also devoid of this tooth.

Pfeiffer, Forbes and Hanley consider this species identical with the *Pupilla muscorum* of Europe. The differences will be seen at

once between the two species by comparing the following figures.

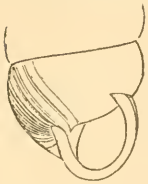


Fig. 89.



Fig. 90.

Figure 89 is *Pupilla badia* from Portland, Maine; Figure 90 represents a specimen of *P. muscorum* from Europe. *P. muscorum* having the same number of whorls, is a much smaller shell than *P. badia*, the labrum is also

thicker, and behind the labrum the thickening appears like a light colored band, which we do not observe in *Pupilla badia*.

VERTIGININÆ.

Isthmia ovata, Say.

Occurs under chips and stones in open fields, close by pools of water; have also found it in drier situations. More common near the coast.



Fig. 93.

Buccal plate, (Fig. 93,) corneous, strongly arcuate, cutting edge projecting in the centre, sides square and parallel with a transverse line of the body. Plate wrinkled longitudinally.

Lingual membrane 90-14-1-14, central plate large, square, with rounded corners, furnished with three short denticles, and also on the posterior edge two elevations; laterals long and narrowing *posteriorly*, tridentate, inner denticle slightly larger; uncini broad and short, with four small denticles, or rather notched. (Pl. 10, Fig. 94.)

Isthmia Gouldii, Binney.

Found generally in company with smaller species of Pulmonates. Body light bluish, blotched with black, tentacles black, rather long, swelling at tip, a black line from tentacles extending along the back. The shell is carried high on the back. In motion they are exceedingly lively.

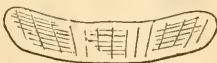


Fig. 95.

Buccal plate, (Fig. 95,) slightly arcuate, rounded at sides, of the same length throughout, longitudinally lined, and transversely striated.

Lingual membrane, 75-11-1-11, central plate square, notched at the outer posterior corners, having three small rounded denticles, laterals square, bidentate, uncini minutely notched. (Pl. 10, Fig. 96.)

Isthmia milium, Gould.

Mr. C. B. Fuller has met with this species in an open field near the coast.

Isthmia simplex, Gould.

This species is generally distributed throughout the southern portions of the State, though by no means common.

AURICULIDÆ.

AURICULINÆ.

Carychium exiguum, Say. (*Fig. 97.*)

Occurring throughout the State, more abundant in the interior; generally preferring low wet ground.

Lingual membrane having numerous rows of plates, each row having one central flanked on each side by sixteen laterals; central plate long, narrow, having one minute pointed denticle; first four laterals armed with one short rounded denticle, next six laterals bidentate, the rest which probably comprise the uncini, broad simple recurved plates. Plates translucent, denticles light horn color. (*Pl. 10, Fig. 99.*)

This dentition has a strange similarity to that of *Punctum minutissimum*, in the form and arrangement of plates and the light horn color of the denticles.

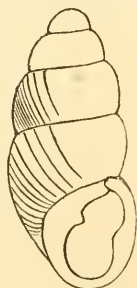


Fig. 97.

Though the resemblance between this species and the *Carychium minimum* of Europe is very close, and has often been remarked upon, they have never been united, either by American or (to my knowledge) European writers. The *Carychium minimum* as will be seen by Figure 98, is more inflated than our species, and the aperture is more oblique also; the parietal tooth is quite prominent in *C. minimum* as compared with our species; the palatal tooth in *C. exiguum* is nearer the base of the shell, and the columellar tooth is a slight fold only within the aperture.

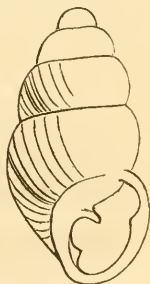


Fig. 98.

Alexia myosotis, Drap.

Found in the interstices of a sea wall in Portland Harbor, at low tide.

Lingual membrane having fifty-one plates in a row, central plate wide, narrowing anteriorly, having one short rounded denticle, laterals comprising half the number of plates in a row, merging into uncini, laterals having one short denticle, uncini bidentate. (*Pl. 10, Fig. 100.*)

MELAMPINÆ.

Melampus bidentatus, Say.

Mr. Fuller has found a few dead specimens of this species several miles west of Portland. Mr. A. E. Verrill states that he found this species at Anticosti, in the Gulf of St. Lawrence.

LIMNÆIDÆ.

PLANORBINÆ.

Planorbis lentus, Say.

Not common.

Helisoma bicarinatus, Say.

Abundant in all parts of the State.

Helisoma trivolvis, Say.

Found by A. E. Verrill at Norway, Maine; it has also been found in one or two other places in the State.

Planorbella campanulatus, Say.

Found in abundance in certain localities; not nearly as common as the preceding species.

Planorbula armigerus, Say.

Generally diffused throughout the State, though not a common species.

Gyraulus hirsutus, Gould.

Quite rare; I collected specimens at Eagle Lakes, in the northern part of the State.

Gyraulus deflectus, Say.

Occurs at Norway Pond, very rare.

Gyraulus parvus, Say.

Profusely distributed throughout the State, occurring in almost every muddy brook, ditch, and puddle.

Gyraulus dilatatus, Gould.

A few specimens only have been found in Harrison, Maine.

Menetus exacutus, Say.

Nearly as rare as the preceding species.

L I M N Æ I N Æ.

Limnophysa desidiosa, Say.

Abundant in every small body of water.

The young of this species were plainly seen eating their way out of the ovarian envelope, the mouth seemed to occupy the whole space between the eyes which were wide apart. The lingual membrane of the young just issued from the egg, is long and narrow, composed of thirty-eight rows of plates, each row made up of one minute central plate, flanked by four laterals on a side.

A specimen of this species tightly corked in a vial of water showed signs of uneasiness after three hours had elapsed; at the expiration of seven hours the animal was greatly exerted from the shell, showing slight motion though apparently insensible to touch.

Limnophysa elodes, Say.

Of rare occurrence in the State.

Limnophysa humilis, Say.

Southern parts of the State. Very abundant near Portland.

Limnophysa caperata, Say.**Limnophysa catascopium**, Say.

Very abundant in the vicinity of the mouth of the Androscoggin River, in company with *Physa ancillaria*.

Radix columella, Say.

Very common in the southern portions of the State, rare in the interior.

Radix ampla, Mighels.

Found a few dead specimens of this species in Mud Lake, at the northern part of the State, the original place of discovery. I was led at one time to believe this a variety of *L. catascopium*, Say, through its resemblance to *L. decollata*, Mighels, which I believe to be a variety of *L. catascopium*.

Radix decollata, Mighels.

Having had specimens of this species from Dr. Mighels' original collection, and having compared them carefully with modified *L. catascopium* from that region, I see no reason to differ from the opinion expressed by Haldeman in his "Monograph of the *Limnæidæ*," in which he considers it a variety of *L. catascopium*. The shortened spire and solid character of the shell is peculiar to many specimens of *L. catascopium* from that vicinity. This peculiar decollate form has not been found elsewhere in the State.

PHYSINÆ.

Physa heterostropha Say.

A very common species in all our brooks; cold springs appear to be a favorite resort for this species. There appears to be no constant character in the digitations of the mantle margin; in

some it is divided into thick lobes, in others it assumes the appearance of long lashes. The body varies in color from a light olive green or yellow, to a dusky olive. Buccal plate thin, colorless, triangular, longitudinally striate, cutting edge minutely notched. I enclosed a specimen of this species in a small vial filled with water and corked tight, for the purpose of seeing how long the animal could exist without access to the air; for some time it continued very active in its attempts to procure air, and in whatever position I changed the vial, it assumed a perpendicular position in crawling; after the lapse of several hours it became sluggish, and at the expiration of seventeen hours all parts of the animal protruded from the shell, though it showed slight contraction on being placed in alcohol.

***Physa ancillaria*, Say.**

Generally diffused throughout the State, though not so common as the preceding species.

Mighels mentions its occurrence in the northern parts of the State. This species is extremely variable in its appearance, and I have noticed in the State nearly all its varieties figured by Haldeman in his *Monograph of the Limnæidæ*.

***Physa gyrina*, Say.**

Dr. Mighels mentions the occurrence of this species in the State. I have never seen it, neither can I see sufficient grounds for separating the form described as such from *P. heterostropha*.

***Physa fragilis*, Mighels.**

We have every reason to believe this shell to be a variety of *P. ancillaria*. The circumstances attending its discovery lead to this belief. The shell was found in a mill stream charged with wood dust from a neighboring saw mill. In the waters above the mill, *P. ancillaria* occurred in abundance, with no trace of *P. fragilis*. This mill was afterward destroyed, and nearly synchronous with this event was the entire obliteration of *P. fragilis* and the recurrence of the normal form *P. ancillaria*; nothing ap-

proaching this abnormal form has elsewhere been observed in the State.

Nauta elongata, Say.

Occurs in the vicinity of Portland, Maine. I found one specimen of this species at Bethel, Maine, the only time I have ever noticed it inland. The animal agrees with Say's description in having a white ring surrounding the base of tentacles, a feature which Dr. Gould says he failed to notice in Massachusetts specimens.

ANCYLINÆ.

Ancylus parallelus, Hald.

Occurs in several places in Cumberland County. The animal is white throughout, the tentacles are short, blunt, cylindrical and wide apart, head wide, and obtuse: Buccal plate is a thin corneous horse-shoe shaped lamina. The body is capable of turning almost completely round in its shell. The heart is on the right side of the animal, about midway between the two extremities of the body, and pulsates forty-eight times per minute.

Ancylus rivularis, Say.

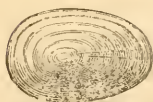
Quite rare.

Ancylus tardus, Say.

Catalogued by Mighels.

Ancylus ovalis. NOV. SP. (Figs. 101, 102.)

I propose this, and the following species with some reluctance, as the specific characters of nearly all the species of this genus are but faintly marked, and the danger of multiplying false species is but too apparent; still believing these to be new, I present them.



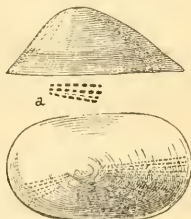
(Figs. 101, 102.)

Shell very small, depressed, irregularly ovate, apex nearly central, round, smooth and blunt,

slightly inclined to the left; slopes irregular, caused by different periods of repose and growth; posterior slope in most specimens straight, anterior slope convex, lateral slopes steep; shell widening anteriorly; lines of accretion extremely fine, visible within but requiring a magnifier to discern them without, being greatly obscured by fine grains of sand agglutinated to the surface. Periostraca pale yellow, the surface when magnified exhibits about fifty-five delicate ribs, which radiate from the apex to the periphery of the shell. Length .12 inch, breadth .10 inch, height .06 inch. This species was discovered by John M. Gould, in the Androscoggin River, at Bethel, Me., in 1854. I have since found it in the above locality clinging to the under side of stones near the shore, in positions where it could in no way reach the surface of the water.

Ancylus borealis. NOV. SP. (*Figs. 103, 104.*)

Shell elliptical, solid, light yellow, apex elevated, rounded, very obtuse, nearer the posterior margin of the shell; lateral slopes steep, anterior slope slightly convex, near the apex; posterior slope straight. Fine regularly interrupted radiating lines mark the surface of the shell from the apex to the borders: incremental lines irregular. Length .14 inch, breadth .09 inch, height .06 inch.



This species resembles *A. tardus* in its general form. It is much smaller however, and has a strong heavy shell. Discovered by John M. Gould at Patten, in the northern part of the State.

VIVIPARIDÆ.

Melantho decisa, Say.

Abundant throughout the State, though the shell never attains that size and perfection which characterize the same species in the western states. Heterostrophed specimens are frequently met with in embryo.

The lingual membrane examined in one specimen of this species presented the singular anomaly of eight laterals thus, 4-1-4, the constant formula being 3-1-3.

AMNICOLIDÆ.

Amnicola limosa, Say.

Very common. The animal agrees precisely with Say's description, except that he does not mention a white line running along each tentacle.

Amnicola porata, Say.

Not so common as the preceding.

Amnicola decisa, Hald.

A species agreeing precisely with Haldeman's figure and description, occurs in the vicinity of Portland.

VALVATIDÆ.

Valvata tricarinata, Say.

Very large specimens of this species were found in abundance at Bowdoinham; also dredged in Mud Lake, in the northern part of the State.

Valvata sincera, Say.

Dredged in Mud Lake, N. Lat. 47°. Have it also in abundance from Lawler's Lake, seven miles from St. John, N. B., through the kindness of Mr. Verrill. Among the specimens in this lot are many in which the whorls are entirely separated from each other, giving the shell a most singular appearance.

Lyogyrus pupoidea, Gould.

Occurs rarely in the southern portions of the State. *Amnicola lustrica*, Say, is probably the immature form of this species. I have specimens answering perfectly to Say's description of *Amnicola lustrica*, which has an orbicular operculum, and I can detect no difference between these and the young of *V. pupoidea*. Say in his description of *A. lustrica*, expresses the opinion that it might be referable to *Valvata*. He was led to this opinion by the circular aperture.

UNIONIDÆ.

Anodonta fluviatilis, Lea.

Common in quiet muddy ponds, and artificial bodies of water.

Anodonta marginata, Say.

Not common.

Anodonta implicata, Say.

Strophitus undulatus, Say.

Strophitus sculptilis, Ag.

Alasmodonta marginatus, Say.

Margaritana arcuata, Barnes.

Found in great numbers in several rocky muddy brooks near Portland. Have rarely found it in the interior.

Lampsilis ochracea, Say.

A few specimens of this species has been found in the Penobscot River.

Lampsilis radiata, Say.

Common throughout the State; inhabiting large ponds. Some forms resemble closely the *Lampsilis siliquoidea*.

Unio complanatus, Lea.

A very common species in all bodies of water. Extremely variable in its external characters, almost every pond in the State exhibiting some form of this species peculiar to its waters.

CORBICULIDÆ.

Sphærium sulcatum, Lam.

Hallowell, Maine. (*Prime.*)

Sphærium striatinum, Lam.

Sphærium striatinum, Lam. var., *acuminata*, Prime.
Eagle Lakes, N. Lat. 47°.

Sphærium partumeium, Say.

Common.

Sphærium tenue, Prime.

Androscoggin, Maine. (*Prime.*)

Sphærium securis, Prime.

Little Androscoggin River.

Sphærium truncatum, Linsley.

Maine. (*Prime.*)

Pisidium Virginicum, Bourguignat.**Pisidium Adamsii**, Prime.**Pisidium æquilaterale**, Prime.

Augusta, Maine. (*Prime.*)

Pisidium compressum, Prime.

Augusta, Maine. (*Prime.*)

Pisidium variabile, Prime.

Common in all ditches.

Pisidium abditum, Haldeman.

With all its varieties, common.

A few species of fresh water Polyzoa have been observed in the State, but not having the means for their proper identification I cannot present them.

From the foregoing catalogue, it will be seen that thus far, forty-nine species of terrestrial, and fifty-five species of fluviatile mollusca have been detected in the State; as a consequence however of its geological formation which is made up chiefly of azoic rocks, covered with extensive tracts of coniferous trees, the land mollusks do not occur in that profusion which characterizes the faunas of many other States; for it is well known that the presence of coniferous trees, exerts a retarding influence on the growth and increase of the land pulmonates; and, on the contrary, that hard wood growths and calcareous soils are most congenial to their existence and perpetuation. The meagerness of the soil, and the general prevalence of pine forests, must therefore in a measure account for the absence of several species occurring farther west, and are certainly the cause of that scarcity of individuals which truly characterizes the molluscan fauna throughout this State. It is believed that when our unexplored districts at the north are carefully investigated many forms new, either to the State or to science, will be revealed.

It is interesting to compare the increase made from time to time, in the species enumerated in the few catalogues of Maine shells, which have been published, with the number catalogued in this paper.

	<i>Land.</i>	<i>Fresh water.</i>	<i>Total.</i>
1836. Jackson's Report Geology of Maine,	3	11	14
1841. Mighels' first catalogue,	16	34	50
1842. Mighels' second catalogue,	22	35	57
1864. This catalogue,	49	55	104

We give below a table showing the number of land and fresh water species of Mollusks in England, Scotland and Ireland for comparison with those of Maine. It will be seen that while the land species outnumber the fresh water species in Britain, it is quite the reverse in Maine. In Britain also we have several genera of land mollusks which do not occur in Maine, such as *Cyclostoma*,

Clausilia, Balea, Azeca and Testacella, while in Maine we have only one form not found in Britain, namely, Tebennophorus.

	<i>Square Miles.</i>	<i>Land.</i>	<i>Fresh water.</i>	<i>Total.</i>
England,	50,922	77	48	125
Scotland,	31,324	46	30	76
Ireland,	32,513	60	39	99
Maine,	31,766	49	55	104

GEOGRAPHICAL DISTRIBUTION.

A very few facts worthy of remark have been noted relative to the geographical distribution of the terrestrial and fluviatile mollusca of Maine. Though the area of the State is nearly as large as the other five New England States together, embracing an extent of 31,766 square miles of surface, we find as a general thing an equable distribution of species in all its parts; though the occurrence of some species is more frequent in certain regions of the State than in others. The Linnæidæ appear to be confined almost exclusively to the southern portions of the State. Among the species occurring from one extremity of the State to the other, we have *Hyalina arborea*, *H. electrina*, *Conulus chersina*, *Striatura milium*, *Patula striatella*, *Mesodon albolabris*, *Succinea Totteniana*, *S. avara*, *Vitrina limpida*, *Isthmia Gouldii*, *Helisoma bicarinatus*, *Planorbella campanulatus*, *Menetus exaetus*, *Gyraulus parvus*, and *Unio complanatus*. Of those more common near the coast we find *Strobila labyrinthica*, *Anguispira alternata*, *M. albolabris*, *Vallonia minuta*, *Tachea hortensis*, *Zua lubricoidea*, *Succ. ovalis*, *S. Totteniana*, *Zoögenetes harpa*, *Leucochila pentodon*, *Pupilla badia*, *Isthmia Gouldii*, *I. ovata* and *I. milium*. Of the ones more common to the western and central portions of the State, though many occur on the coast, are *Triodopsis dentifera*, *Mesodon Sayii*, *Helicodiscus lineata*, *Hyalina multi-dentata*, *H. indentata*, *Planogyra asteriscus*, *Pseudohyalina exigua*, *Punctum minutissimum*, *Tebennophorus Carolinensis*, *Pallifera dorsalis*, *Limax campestris*, *Isthmia simplex*, *Leucochila contracta*, *L. corticaria*, and *Carychium exiguum*, *Triodopsis dentifera*, *Macrocyclus concava*, *H. multidentata*, *P. asteriscus*, *L. corticaria*.

L. contracta and *Gyraulus dilatatus* are confined to a few places many miles from the coast, while *Tachea hortensis*, *Hyalina cellaria*, *Pseudohyalina minuscula*, *Isthmia milium*, *Pupilla badia* and the

European Limaces are found only directly on the coast. All the species of land pulmonates of the State with the exception of *T. hortensis*, *P. minuscula*, *H. cellaria*, *P. badia*, *Isthmia milium* and the European Limaces occur at Bethel on the Androscoggin river seventy miles inland from Portland; and, with the exception of *T. dentifera*, *M. concava*, *H. multidentata*, *P. asteriscus*, *L. contracta* and *L. corticaria* are also found in the immediate vicinity of Portland. *Margaritana arcuata* I have noticed to be more common in brooks near the coast. Anodontas reach their highest state of development in mill ponds and canals; *Lampsilis radiata* is generally found in ponds, and *Strophitus undulata* and *Unio complanatus* are found in nearly all bodies of water.

The following we quote from the Second Annual Report upon the Natural History and Geology of the State of Maine; 1862, page 132; it is contained in the report of Marine Zoölogy by C. B. Fuller. "On the Brown Cow and Eagle Islands (Casco Bay) which are nearly destitute of vegetation, I found the following land shells in abundance, *Helix nemoralis*, *Helix albolabris* and *Succinea obliqua*. On Eagle Island, a short distance from the above, *Helix alternata* occurs in great numbers. Almost every island in the bay has a mollusk peculiar to itself, and coincident with its soil or flora. Eagle Island bearing spruce and fir produced *Helix alternata*, while one of the Goose Islands with a hard wood growth produced *Helix albolabris* abundantly."

The following species of terrestrial and fluviatile mollusca accredited to New England by Stimpson, shells of N. E. 1851, have not as yet been detected in this State.

GASTEROPODA.

Triodopsis tridentata, Say.

“ *palliata*, Say.

Stenotrema hirsuta, Say.

Omphalina inornata, Say.

Omphalina fuliginosa, Griffith.

Ventridens suppressa, Say.

Leucochila fallax, Say.

“ *armifera*, Say.

Limnæa appressa, Say.

Bulimnea megasoma, Say.

Acella gracilis, Say.

Ancylus fuscus, Adams.

Melania depygis, Say.

Amnicola pallida, Hald.

ACEPHALA.

Eurynea prælonga, Barnes.

“ *nasuta*, Say.

Lampsilis cariosa, Say.

“ *ventricosa*, Barnes.

“ *siliquoidea*, Barnes.

Metaptera alata, Say.

“ *gracilis*, Barnes.

Complanaria rugosa, Barnes.

“ *alasmodontina*, Barnes.

Anodonta Benedictensis, Lea.

“ *Housatonica*, Lea.

“ *cylindracea*, Lea.

In a catalogue of the species of Corbiculadæ contained in the collection of Temple Prime, 1863, we find the following New England species, which have not as yet been found in this State.

Sphærium rhomboideum, Say.

S. occidentale, Prime.

S. Vermontanum, Prime.

Pisidium ferrugineum, Prime.

P. ventricosum, Prime.

By the above list it will be seen that while there are only fourteen species of gasteropods not found in Maine, there are

nearly the same number of Unionidæ absent—showing not only a more general distribution of the former class, but exhibiting also the continual reduction of species of Unionidæ as one goes East from the Ohio and Mississippi valleys. In New Brunswick and Nova Scotia we shall undoubtedly observe a still less number of species in this family. The Melanidæ so numerous in the West, have not a single representative in all the lakes and rivers of Maine, and only one species is found in New England.

ABUNDANCE OR SCARCITY OF SPECIES VARIABLE.

Having recently revisited old collecting grounds of 1856, I was struck with the difference in the proportion of individuals of certain species existing now, and at that time; some which were rarely to be met with in that year, are now common, while others which were then met with in abundance are now rare; and I believe it to be a well established fact with collectors that certain species become rare or disappear in certain places where they were at one time common, and suddenly appear in places which had hitherto been well searched without affording a single example of the new tenant. I am informed that certain species of Unionidæ which were at one time common on the Ohio river are not now to be met with, while other species not known to have inhabited that river by our earlier zoölogists are now to be frequently found. This may in part be owing to a careless search in which certain species are probably overlooked; but that species do appear, or disappear, or become more or less common in certain areas, there is abundant proof. A partial solution of this question regarding the terrestrial pulmonates may be found in the fact that a severe and long continued drought may so reduce the number of individuals that the few surviving ones may absolutely elude detection, while on the other hand, a favorable season of humidity and warmth may so affect the species that its former numerical proportion of individuals be at once regained. In connection with this subject it is interesting to compare the changes which have taken place in this State, in the greater or less abundance of individuals of certain species, with their condition twenty years ago. In the fourth volume of the *Boston Journal of Natural History*, (1843) will be found a catalogue of the shells of Maine by Dr. J. W. Mighels in which he remarks on the greater or less

abundance of each species, and as he had several earnest coadjutors collecting for him in various parts of the State, and was himself an indefatigable collector, we must believe that his observations were in the main correct. It will be seen by the following, that several species common to the State twenty years ago, are not now so common, while others which were then rare are now exceedingly abundant. Those species on which no remarks are made remain the same. The quotations are from Mighels' paper above referred to.

MESODON ALBOLABRIS.	{ "Solitary in all parts of the State, and on islands in Casco Bay." Found in the greatest abundance on many islands, and have met with them in numbers in the interior.
ANGUISPIRA ALTERNATA.	{ "Abundant." Abundant on several islands only.
HYALINA INDENTATA.	{ "Appears to be rare." Not rare.
HYALINA ELECTRINA.	{ "Rare." Quite common.
CONULUS CHERSINA.	{ More abundant than his would appear to indicate.
STROBILA LABYRINTHICA.	{ "Found sparingly." Common.
PUPAS and VERTIGOS.	{ Were noted as found sparingly by Dr. Mighels, we find many of them common.
ZOÖGENETES HARPA.	{ Is now abundant in the vicinity of Portland, but could not have been thus abundant years ago, as Mighels had not found it at that time.

- SUCCINEA
AVARA. { Mighels mentions only one habitat, but it is
now abundant in many places.
- HELISOMA
BICARINATUS. { "Not aware that it is abundant anywhere."
Very common and abundant.
- PLANORBELLA
CAMPANULATUS. { "Abounds in all parts of the State."
Do not meet with it thus frequently.
- LIMNOPHYSA
DESIDIOSA. { "Rare."
Extremely abundant everywhere.
- RADIX
AMPLA. { The discoverer asserts that this species was
very abundant in second Eagle Lake N. Lat.
47°: he also found Physa ancillaria, "summer
of 1842." In the summer of 1859 Mr. John M.
Gould and myself made a careful survey of
this lake by closely examining its shores, and
by dredging in various parts of the lake, and
met with no specimen of Physa ancillaria, and
but six or seven dead specimens of Radix
ampla, though we found an abundance of Am-
nicolæ, Valvatæ and Planorbes.
- ANCYLUS
RIVULARIS. { "Found in plenty."
Ancyclus is one of our scarcest shells.

CHRONOLOGICAL LIST

of all the publications especially referring to the mollusca of this State.

Year.

1836. A list of shells in Jackson's Report on Geology of Maine.
1841. J. W. Mighels M. D. Catalogue of the Marine, Terrestrial and Fluviatile shells of the State of Maine—on double sheet, published by the author.
1842. J. W. Mighels M. D. and Prof. C. B. Adams—Description of twenty-four species of the shells of New England, with a plate. *Bos. Jour. Nat. Hist.*, Vol. IV, p. 37.
1843. J. W. Mighels M. D. Catalogue of the Marine, Fluviatile and Terrestrial shells of the State of Maine and adjacent ocean. *Bos. Jour. Nat. Hist.* Vol. IV, p. 308.
1843. J. W. Mighels, M. D. Descriptions of six species of shells regarded as new, with a plate. *Bos. Jour. Nat. Hist.* Vol. IV.
1844. J. W. Mighels, M. D. Description of a supposed new species of Pupa. *Proc. Bos. Soc. Nat. His.* Vol. I, p. 187.
1854. J. W. Chickering, Jr. List of Marine, Fresh-water and Land shells found in the immediate vicinity of Portland, Me., double sheet published by the author.
1857. Edward S. Morse. Description of a new species of Helix. *Proc. Bos. Soc. Nat. His.* Vol. VI.
1859. Edward S. Morse. Description of a new species of Helix. *Proc. Bos. Soc. Nat. His.* Vol. VII, p. 28.

1862. Edward S. Morse, on the occurrence of *Helix multidentata* beneath Indian deposits. Proc. Portland Soc. Nat. His. Vol I, p. 98.
1862. C. B. Fuller, Report on Marine Zoölogy in Report on the Agriculture and Geology of Maine for 1862, p. 129.
1864. Edward S. Morse, Synopsis of the Fluvial and Terrestrial Mollusca of the State of Maine, double sheet, published by the author.

The following cuts were omitted in their appropriate places :

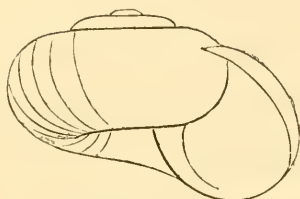


Fig. 25, p. 13.

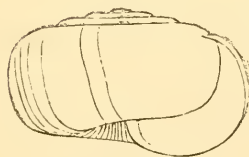


Fig. 80, p. 15.

EXPLANATION OF PLATES.

PLATE I. *Zoögenetes harpa*—Say.

Fig. 1—represents natural attitude of this species.

Fig. 2—the shell of the same.

Fig. 3—represents a ventral view of this species.

Fig. 4—the oviduct with the closely adhering ovary at its summit, the oviduct being filled with four embryos in various stages of development.

Fig. 5—Ganglionic centres, surrounding the œsophagus, of an adult.

Fig. 6—a young one just excluded by the parent.

Fig. 7—an embryo.

Fig. 8—the sub-œsophageal gangli containing the auditory vesicles, embryonic.

Fig. 9—Otoconites; embryonic.

Fig. 10—a row of plates from the lingual membrane of an adult.

Fig. 11—the same from an advanced embryo.

Fig. 12—the same from a less advanced embryo.

Fig. 13—the buccal plate.

Fig. 14—the shell of an embryo.

Note. All the above views are more or less magnified.

PLATE II.

Magnified views of the exterior surfaces of the shells of the following species.

Fig. 1—*Punctum minutissimum*, Lea.

a. section of same.

Fig. 2—*Stenotrema monodon*, Rackett.

Fig. 3—*Helicodiscus lineata*, Say.

Fig. 4—*Conulus chersina*, Say.

Fig. 5—*Planogyra asteriscus*, Morse.

Fig. 6—*Patula striatella*, Anthony.

Fig. 7—*Striatura milium*, Morse.

Fig. 8—*Pseudohyalina exigua*, Stimpson.

Fig. 9—*Hyalina Binneyana*, Morse.

Fig. 10—*Striatura ferrea*, Morse.

Fig. 11—*Hyalina indentata*, Say.

Fig. 12—*Strobila labyrinthica*. Say.

a. upper portion of whorl.

b. lower portion of whorl.



Fig. 3.

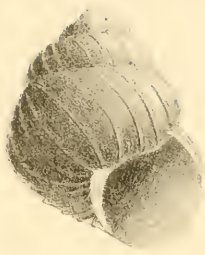


Fig. 2.

Nat. Size



Fig. 1.



Fig. 4.



Fig. 14.

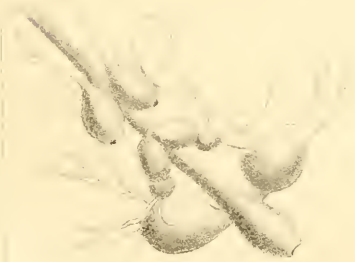


Fig. 5.



Fig. 6.



Fig. 13.



Fig. 8.



Fig. 9.

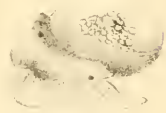


Fig. 7.

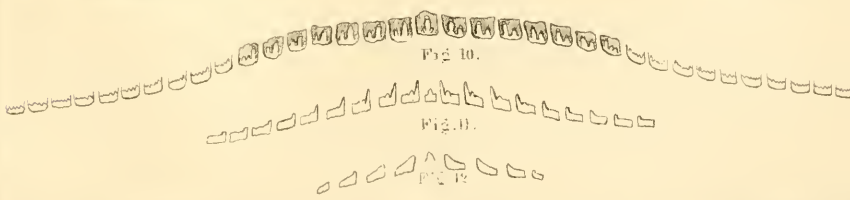


Fig. 10.

Fig. 11.

Fig. 12.

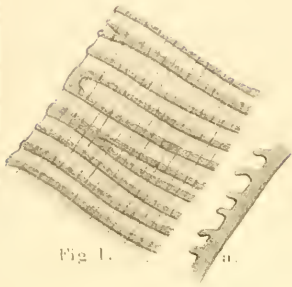


Fig. 1.



Fig. 2.

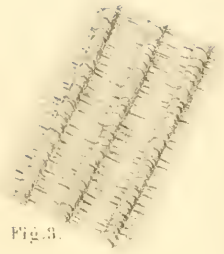


Fig. 3.

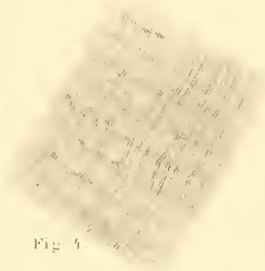


Fig. 4.

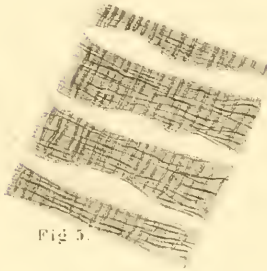


Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.



Fig. 11.

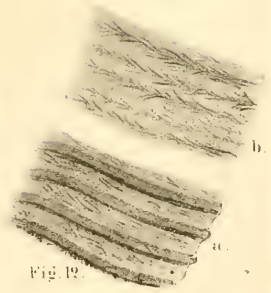
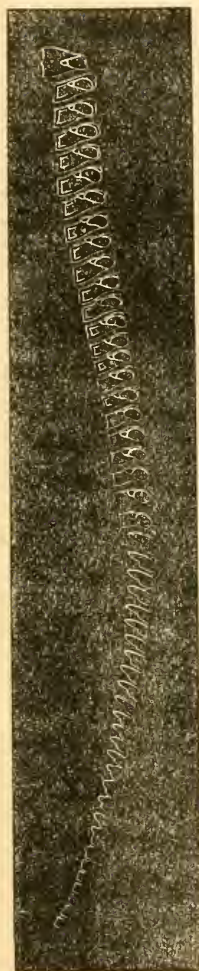
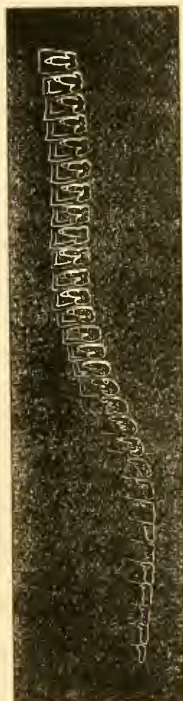


Fig. 12.

PLATE 3.



Tetaneophorus Carolinensis, Fig. 4.



Pallipen dorsalis, Fig. 6.



Linnae agrystis, Fig. 2.



M sodon allolabris, Fig. 8.



Mesodon Sagii, Fig. 10.



Stenotrema moxodou, Fig. 11.



Tachea hortensis, Fig. 12.



Aegospira alternata, Fig. 16.



Vitrea limpida, Fig. 17.



Macrocypris cucurva.



Hyalina cellaria, Fig. 20.



Hyalina involutata, Fig. 22.

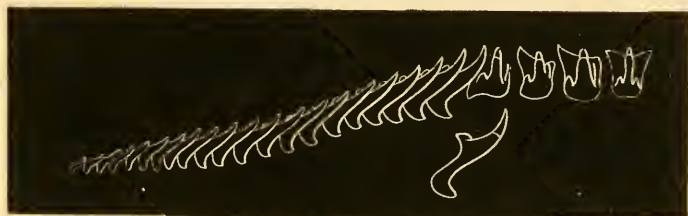
PLATE G.



Hyalina arborva, Fig. 29.



Hyalina electrina, Fig. 24.



Hyalina Binneyana, Fig. 27.



Hyalina multidentata, Fig. 32.

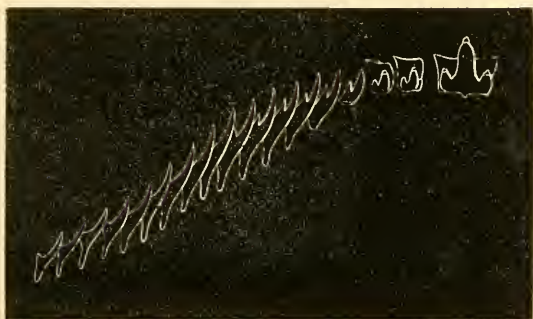
PLATE 7.



Pseudohyalina exigua, Fig. 33.



Pseudohyalina minuscula, Fig. 35.



Striatura milium, Fig. 43.



Striatura ferrea, Fig. 40.



Comulus chersina, Fig. 45.

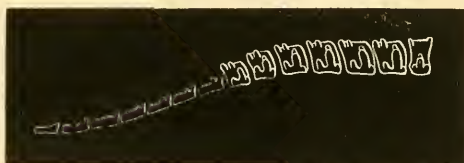
PLATE 8.



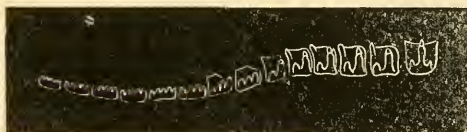
Vallonia minuta, Fig. 57.



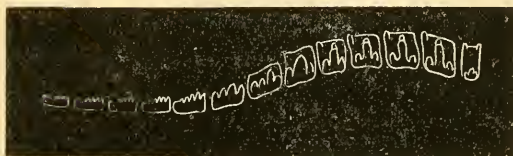
Patula striatella, Fig. 49.



Planogyra asteriscus Fig. 53.



Strobila labyrinthica, Fig. 68.

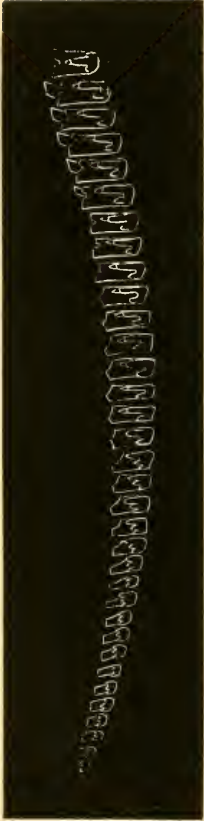


Helicodiscus lineata, Fig. 63.



Punctum minutissimum, Fig. 71.





Succinea Totteniana, Fig. 74.



Succinea avara, Fig. 76.

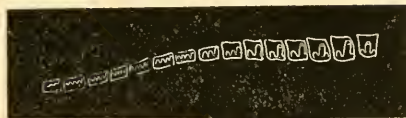


Succinea ovalis, Fig. 78.

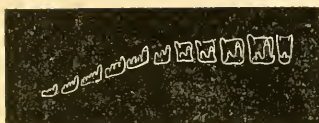
PLATE 10.



Zua lubricoidea, Fig. 82.



Pupilla badia, Fig. 92.



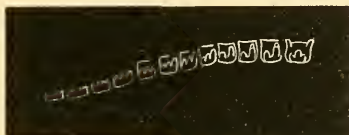
Leucochila pentodon, Fig. 86.



Leucochila corticaria, Fig. 88.



Isthmia ovata, Fig. 94.



Isthmia Gouldi, Fig. 96.



Carychium exiguum, Fig. 99.



Alexia myosotis, Fig. 100.



