BULLETIN

OF THE

ESSEX INSTITUTE.

VOLUME XXII.

1890.

SALEM, MASS.:
PRINTED AT THE SALEM PRESS PUBLISHING AND PRINTING CO.,
1891.

CONTENTS.

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VOL. 22. SALEM: JAN., FEB., MAR., 1890. NOS. 1-2-3.

ON THE SPECIES OF THE GENUS CHALCINUS IN THE MUSEUM OF COMPARATIVE ZOOLOGY AT CAMBRIDGE, MASS., U. S. A.

BY S. GARMAN.

THE Thayer Expedition of Professor L. Agassiz and his party, to Brazil, collected a large number of duplicate specimens of species of Characinidæ. In preparing these for distribution to the correspondents of the Museum they have been identified from the original descriptions with results that do not agree with others of recent publication. As a consequence of disagreement with the constitutions of the genera as heretofore accepted, it is thought advisable to publish the conclusions in this place.

There are several general features of Chalcinus that deserve a few words of notice before dealing with the separate species. The labial folds and the barbels are present on each of the various forms, with the possible, but unlikely, exception of *C. paranensis.* The latter is known to me only by the description, yet it agrees so closely with

the short variety of *C. angulatus* that absence of the features mentioned would be rather unexpected, and if present, as I have no doubt they are, they should be placed among the generic characters. There are two series of intermaxillary teeth in young specimens. On the other hand, old specimens apparently have three more or less perfect series in the same region. This difference in individuals of the same species is brought about somewhat as follows: the third tooth of the inner row on each side of the symphysis is crowded outward to take a position between the two rows; then, as the growth of the specimen continues, the first tooth on each side of the middle of the outer row is crowded inward, the third tooth of each section of this series afterward follows in the same direction, and still later the fifth tooth shows a disposition toward similar displacement, thus eventually producing what might be described as a triserial arrangement of the intermaxillary teeth. The amount of curvature from snout to tail, in the dorsal outline, as given in descriptions is to be taken with some allowance; it varies greatly with the age and degree of plumpness of the individual and also changes in death and in alcohol. Including several varieties, the following species seem to be all that can be recognized at present.

Scales from upper edge of gill opening to caudal 30–40;
- rays in the anal fin 24 (23) . . . *C. pictus.*
- rays in the anal fin 28–33;
  - from dorsal to lateral line 6 scales;
    - lateral line of 32 scales . *C. paranensis.*
    - lateral line of 33–40 scales *C. angulatus.*
  - from dorsal to lateral line 5 scales;
    - base of anal extending beneath that of dorsal;
      - form short and deep . *C. güntheri.*
    - base of anal behind that of dorsal;
      - form elongate . . . . *C. albus.*

Scales from upper edge of gill-opening to caudal 40–47 ;
rays in the anal fin 27–32 ;
first anal ray behind the dorsal . *C. elongatus.*
rays in the anal 30–34 ;
first anal ray beneath middle of dorsal *C. culter.*
rays in the anal 35–41 ;
first anal ray in front of dorsal *C. magdalenæ*

CHALCINUS ANGULATUS Spix and Ag. ; C. V.

C. brachipomus C. V.
C. mülleri Fil.
C. trifurcatus Cast.
C. nematurus Kn.
Triportheus flavus Cope.

Valenciennes states in his description of *C. brachipomus* that the length is about three and a half times the height and nearly five times the length of the head, which proportions, together with the characters assigned it, seem to necessitate placing it as a synonyme with *C. angulatus*. *C. brachypomus* of Günther is so different in essential respects from that of Valenciennes that the two cannot be considered identical. On typical specimens of *C. angulatus* the labial folds and the barbels are short, apparently ; in this and in the other species, they are longer in the young than in the old, and it may be they are the more developed in the spawning season. One of the varieties has a length of barbel that equals or exceeds the diameter of the eye. Examination of a large number of specimens discloses no variation in the number of scales (6) between the first ray of the dorsal and the lateral line. Hab. Coary, Cudajas, Fonteboa, Hyavary, Içá, Jutahy, Lake Hyanuary, Lake José Assu, Manacapouru, Manaos, Obydos, Santarem, Silva, Lake Saraca, Tabatinga, Teffé, Tonantins.

The species as represented in the collection is separable into four varieties beside the type form.

1. *C. curtus*. Distinguished by the shortness of its body and the roundness of its outlines, its depth being more than one-third of its length, without the caudal. The localities indicated are Pará and Arary.

2. *C. vittatus*. Marked by the possession of two or more longitudinal bands on the flank, formed by a spot of dark color about the middle of the posterior border of each scale in the row. Commonly there is a patch of brown near the base of the pectoral. Taken at José Fernandez, Villa Bella, Porto do Moz, and Santarem.

3. *C. signatus*. The bands are absent from the flanks of this form; it is darker on the upper surface than the preceding; the fins are darker on their edges, and there is a transverse band of light color on the caudal. The flanks are silvery. Hab. Rio Puty.

4. *C. fuscus*. On this form the back is very dark; the sides have a golden reflection but the scales are broadly margined with brown on their free edges which makes the fish appear dark colored. Top of head, lips and barbels nearly or quite black. Fins, brownish. Barbels, as long as the eye. From Villa Bella and Lake Hyanuary.

CHALCINUS PARANENSIS Gthr.

D. 11, A. 30, L. l. 32.

According to the description this species has thirty rays in the anal fin, thirty-two or thirty-three scales in the lateral line, six scales between the latter and the first ray of the dorsal, and the length without the caudal is equal to two and two-thirds times the height or four times the length of the head. Described from the Parana river.

CHALCINUS GÜNTHERI nom sp. n.

C. brachypomus Gthr.

D. 11, A. 28, V. 7, L. l. 34.

In this species there are but five scales in a series between

the first ray of the dorsal and the lateral line, and between the latter and the ventral but a single one. Taking one from the San Francisco river as a typical specimen, it is found to have thirty-two rays in the anal, thirty-one scales in the lateral line, counting those on the tail with the others, and its length is about two and one-half times its height or nearly three and three-fourths times the length of the head.

CHALCINUS PICTUS sp. n.

D. 11, A. 24 (23), V. 7, L. l. 32, L. tr. $\frac{5}{1(2)}$.

This species may be classed with the angulata group. Though not quite as slender as the next in order, it bears some resemblance in shape.

A specimen from Jutahy, of five and one-eighth inches, has a length of three times the height or four times the length of the head. There are five scales between the first ray of the dorsal and the lateral line, one between the latter and the ventral, and two between the lateral line and the lower edge of the body. Barbels small; labial folds well marked; intermaxillary teeth in two slightly irregular series. Eye moderate; its diameter is more than one-third of the length of the head and nearly twice the length of the snout. Head rather broad, not very convex between the orbits, which latter are little narrower than the interorbital space. The base of the anal begins a little distance behind the end of that of the dorsal.

Color, in alcohol, golden, lateral edges of scales brownish, top of head light, back little darker. A triangular patch of brown is seen on the pectoral fin, near the base; behind this there is a band of light color, parallel with the posterior border, which is narrowly edged with dark. The middle rays of the caudal are dark; on each side of this dark band there is a light area in front of a transverse black band on the extremity of the fin.

Chalcinus albus.

Triportheus albus Cope, juv.
Chalcinus Knerii St., adult.

D. 11, A. 29–32, L.l. 30–33.

Five scales between the first ray of the dorsal and the lateral line were present on all the specimens examined. The anal fin begins at a little distance behind the base of the dorsal. The middle rays of the caudal are not black as in the preceding; the extremity of the fin is crossed by a black band, in front of which there is a white one.

Secured at Manacapouru, Porto do Moz, Tabatinga, Tajapura, Teffé, Rio Negro, Hyavary and Içá.

Chalcinus elongatus Gth.

"D. 11, A. 28, V. 8, L. l. 45, L. tr. $\frac{6\frac{1}{2}}{3}$."

A considerable variation is to be seen in regard to the amount of convexity of the crown; on the young or on the lean it is much less than on the more plump of the older ones. The barbels are more prominent on the young. The anal rays vary in number from 28 to 32, the scales in the lateral line from 43 to 48, and the scales between dorsal and lateral line from 6 to 7. Next to *C. angulatus*, this species is probably the most common. It was taken at Arary, Cameta, Gurupa, Içá, José Fernandez, Jutahy, Lago Alexo, Lake Hyanuary, Lake José Assu, Manacapouru, Manaos, Montalegre, Obydos, Pará, Porto do Moz, Rio Negro, Santarem, Silva, Lake Saraca, Tabatinga, Teffé, Tonantins and Villa Bella.

Chalcinus magdalenæ St.

"D. 11, A. 35–41, V. 7, L. l. 41."

Six and a half to seven rows of scales above the lateral line, and one and a half rows below it to the ventral, or

three to the lower edge of the body. In this species the base of the anal extends forward to or beyond a vertical from the front extremity of that of the dorsal. Hab. Magdalena, Cauca, Guayaquil.

Chalcinus culter Cope.

D. 11, A. 31–36, V. 7, L. l. 44–48.

There are seven scales above the lateral line to the median line on the back. Localities, Içá, Saô Paolo, Teffé.

ON SPECIES OF GASTEROPELECUS.

BY S. GARMAN.

Gasteropelecus sternicla L.; Pall.

From a Surinam specimen the formula is D. 11, A. 34, L. l. 33, pores 17, D. to A. 14. Numerous specimens from Tabatinga, Lago Alexo and Pará, adult and young, agree closely with this. In the lateral line there is a variation of about three scales, 31–33. Very young ones have minute dots of black pigment in a band on each flank nearly or quite to the head, and in another along the entire lower edge at the base of the anal; they are also more or less thickly sprinkled along the back, over the body and under the chin. Large specimens show similar markings, but, being darker, their marks are less distinct. Specimens from Curupira and Cudajas indicate a wider range of variation: D. 11–12, A. 33–37, L. l. 30–35.

Gasteropelecus stellatus Kn.

D. 14–16, A. 39–42, L. l. 20–22.

A large series of specimens were preserved at each of the following localities: Coary, Hyavary, Manacapouru, Montalegre, Obidos, Saô Paolo, Tabatinga, Teffé and Villa Bella. An individual from Paraguay has D. 15, A. 42, L. l. 21, which does not distinguish it from those of the Amazon. A common mark of the species may be seen in

a brown spot on the anterior rays of the dorsal, and another in the brownish color of the interior or central rays of the pectoral.

GASTEROPELECUS PECTOROSUS sp. n.

D. 15–16, A. 36–40, L. l. 21 (19–22).

The specimens to which this name is given are readily separated from the preceding by the difference in shape. In those of equal length, when compared with *G. stellatus*, *G. pectorosus* is found to be one-fifth deeper from back of head to lower edge of sternal expansion, the anterior edge of the latter approaching the vertical and being more nearly straight. Or, if specimens of equal depth are compared, *G. stellatus* is seen to be one-third the longer. As far as may be determined from the description of *G. securis*, of Filippi, its shape approaches that of *G. pectorosus;* the former is possessed of a larger number of rays (44) in the anal fin. In the latter the pectorals reach farther back than the base of the dorsal. Measurements from those taken at Manacapouru make the length of one, to base of caudal, two and one-fourth, and the depth one and seven-eighths inches. Of another, the length is one and seven-eighths inches and the depth one and one-fifth. Secured at Cudajas, Lago Alexo, Obidos, Tabatinga and Manacapouru.

GASTEROPELECUS FASCIATUS sp. n.

G. strigatus St.

D. 10, A. 25–27, L.l. 30–32.

The outline of this fish is similar to that of *G. sternicla* but it is readily distinguished by its markings. Along the anal margin at the base of the fin there is a narrow band of dark color; parallel to this and half way to the base of the pectoral there is a broader band of similar color;

a third band parallel with the other two passes through the base of the pectoral from the breast to the lateral line; and a narrow stripe of light color edged with darker, extends along the vertebral column on each flank. Usually there are several indistinct spots of darker color on the back, above the light stripe, one of which is situated at the hinder end of the base of the dorsal. A couple of short streaks of dark from the chin appear to meet in an acute angle just behind the eye. The thoracic bands are separated from each other by bands of light color equally wide. In coloration this form resembles to some extent *G. strigatus* of Günther which is said to have four blackish bands on the thorax, radiating from the middle of its convex edge, in addition to a blackish band along the base of the anal fin, and the formula is D. 9, A. 27, L.l. 25. A large number of specimens have been examined, but without discovering one on which there were less than thirty scales in the lateral line. Specimens from Lake Saraca have faint markings, those from Cudajas have them more distinct, but yet appearing faded, while the darkest and most vivid are on those from Manacapouru and Tabatinga.

ON SPECIES OF CYNOPOTAMUS.

BY S. GARMAN.

Cynopotamus gibbosus L. ; C. V.

Search for variation in the number of dorsal rays proved without avail, the number eleven is very constant. The range of variation in the anal includes about ten rays, 50–60. The scales in the lateral line vary from 57–62 ; in the transverse series between the first ray of the dorsal and that of the anal there are usually sixteen scales above the line and fourteen below, rarely fifteen above and thirteen below. The humeral and the caudal spots also vary greatly, being more often present on the young ; sometimes they are absent entirely on specimens from localities whence the greater number are well marked. Collected at Coary, Cudajas, Içа, Javary, Jutahy, Lake Hyanuary, Manacapouru, Manaos, Obydos, Porto do Moz, Rio Negro, Serpa, Silva, Lake Saraca, Surinam, Tabatinga, Ueranduba and Villa Bella.

Cynopotamus pauciradiatus.

Anacyrtus pauciradiatus Gth.

A considerable number were received from Lago do Maximo and Villa Bella. On those of a couple of inches in length, the spots on shoulders and tail are distinct. The rays in the anal vary from 44 to 46 ; the scales in the lateral line from 55 to 57 ; and in the transverse line be-

tween the anterior rays of dorsal and anal there are commonly 12 scales above the line and 12 below; an occasional specimen reaches 13.

Cynopotamus molossus Kner.

On such as were examined the formula stood as follows: D. 11, A. 43–47, L.l. 46, L.tr. $\frac{11-12}{10}$. Humeral and caudal spots distinct on the numerous small specimens from Serpa and Jutahy.

Cynopotamus microlepis.

Epicyrtus microlepis Rht.

On specimens from Obydos there are fifty-seven rays in the anal, ninety-seven scales in the lateral line, and in the transverse series there are twenty-four above the line and twenty-three below it.

Cynopotamus affinis.

Anacyrtus affinis Gth.

Anal rays varying from 53 to 57, scales in the lateral line from 73 to 80, and in the transverse series between dorsal and anal there are 20 to 22 scales above the line and 17 to 19 below it. Humeral and caudal spots small to absent. Collected at Iça, Coary, Javary, José Fernandez, Jutahy, Lago Alexo, Lake Hyanuary, Lake Saraca, Manacapurua, Saô Paolo and Serpa.

Cynopotamus myersii.

Rœboides myersii Gill.

D. 11, A. 51–56, L.l. 88–95, L.tr. $\frac{24-26}{21-23}$.

From the number of specimens collected and the localities this would appear to be one of the most widely distributed and plentiful of these fishes. Hab. Coary, Fonteboa, Javary, Jutahy, José Fernandez, Lago Alexo,

Lake Hyanuary, Manacapoura, Rio Puty, Saô Paolo, San Gonçallo, Serpa, Tabatinga and Tonantins.

Cynopotomus xenodon Rht.; Ltk.

D. 11, A. 50, L.l. 66, L.tr. $\frac{16}{14}$.

In shape and markings the specimens placed under this name closely resemble *C. pauciradiatus*. The rays in the anal vary from 48 to 55, the scales in the lateral line from 61 to 70, and those in the transverse series from 14 to 16 above the line and from 13 to 14 below it. Large numbers were taken at Lake Saraca and at Serpa; it was also secured at Arary, Lago Alexo and Obydos.

Cynopotamus guatemalensis.

Anacyrtus guatemalensis Gth.

On a couple of a number of individuals from the Chagres river, the formula is D. 11, A. 48–50, L.l. 83–90, L.tr. $\frac{19\text{-}21}{21\text{-}23}$. The depth of the body is about two and three-fourths times and length of the head four and one-third times in the total length, without caudal.

Cynopotamus knerii.

Anacyrtus knerii St.

D. 11, A. 46, L.l. 86, L.tr. $\frac{17}{15}$.

Small specimens from Tabatinga have a distinct caudal blotch but are without the humeral spot. The silvery band on the flank is narrow but well defined.

Cynopotamus humeralis C. V.

Near the middle of its length the silvery band of the flank occupies the six scales immediately above the lateral line. The humeral and the caudal spots vary much in depth of color, usually both are present. The number of

rays in the anal vary from 42 to 46. Hab. Rosario, Goyaz, and Saô Paolo.

Cynopotamus biserialis sp.n.

D. 11, A. 47, V. 8, P. 13, L.l. 62, L.tr. $\frac{13}{11}$.

Both upper and lower jaws without external toothlike processes; no canines; teeth conical, in two series on intermaxillaries and on the anterior halves of the mandibles; a single series of maxillary teeth. The two series of teeth on the mandibles serve as a ready means of distinguishing this species from *C. gibbosus*, and *C. pauciradiatus*, which it approaches in shape. The back is elevated, decurved toward the occiput, and the depth is one-third of the length to the bottom of the caudal notch. The head is a little more than one-fourth of the length, excluding the caudal. Eye large, two and two-thirds times in length of head, wider than interorbital space. The maxillary nearly or quite reaches a vertical through the centre of the eye. The fourth or fifth ray of the dorsal fin is in the middle of the entire length, without the caudal, and the anterior ray of the dorsal is slightly behind that of the anal. Flanks silvery, humeral and caudal spots present. Many examples were secured by the Thayer Expedition at Lago do Maximo, Obydos and Villa Bella.

ON THE SPECIES OF THE GENUS ANOSTOMUS.

BY S. GARMAN.

THE characteristics of the various fishes credited to it are such as to divide the genus Anostomus into three comparatively distinct groups or subgenera. The large series collected by the Thayer Expedition for the Museum of Comparative Zoölogy illustrate this to advantage, and at the same time they furnish several types that do not appear to have previously been noticed by ichthyologists. The first of the groups (*Anostomus*) is characterized by an elongate narrow snout, of which a cross section in front of the eyes would be nearly round, by a mouth turned almost directly upward and by long, slender, crenulate mandibular teeth. It contains but two of the species. The second group, to which the name *Schizodontopsis* is given, is marked by a short broad snout, of which a transverse section behind the nostrils would be sub-elliptical; by a mouth turned obliquely upward and forward, and by teeth on the mandible that are broad and truncate, having entire or chisel-shaped edges. Four species of close affinities are to be included in this group. The third of the sub-genera (*Schizodon*) is similar to the second in shape of snout, but the mouth is directed forward or, in one species, obliquely downward, and the mandibular teeth are short, broad, and crenulated. This section includes the six remaining species. The characters assigned *Schizodon sag-*

ittarius will not permit its admission. Apparently it is the young of *Rhytiodon argenteo-fuscus*. The fourth tooth on each side in that species is very small and from its position against the third is not readily discovered. The teeth of the species of Rhytiodon differ considerably, and Kner's figures of those of *R. microlepis* do not well represent those of *R. argenteo-fuscus*, which latter agree somewhat well with those of *S. sagittarius* as described. Aside from the six teeth on the mandible there is nothing in the description that will separate *sagittarius* and *argenteo-fuscus*. The differences between Rhytiodus and Anostomus seem too great to allow of bringing them together as subgenera.

In the following table are indicated the different divisions of the genus Anostomus with their contents.

Snout elongate, narrow, sub-circular in cross section; mouth directed upward, lower teeth long, narrow, crenulate . . (ANOSTOMUS).
series of scales 4 from L.l. to D.;
flank with two longitudinal bands *salmoneus*.
series of scales 6 from L.l. to D.;
flank with two or more spots . *trimaculatus*.
Snout broad, sub-elliptic in cross section; mouth directed obliquely upward and forward, lower jaw longer; lower teeth broad, truncate or chisel-shaped (SCHIZODONTOPSIS).
series of scales 5 from L.l. to D.;
a band along the flank . . . *tæniatus*.
series of scales 6 from L.l. to D.;
a band along the flank;
transverse bands none . . *proximus*.
transverse bands four . . . *varius*.
series of scales 7 from L.l. to D.;
a band along the flank . . . *orinocensis*.

mouth directed forward, lower jaw little if any longer;
lower teeth short, broad, crenulate (SCHIZODON).
series of scales 4 from L.l. to D.;
transversely banded with brown;
bands 3, a caudal band . . *vittatus*.
bands 4, a caudal spot . *fasciatus*.
bands blotch-like, no caudal spot *dissimilis*.
series of scales 6 from L.l. to D.;
transverse bands absent;
rows of scales 5 between L.l. and V. *isognathus*.
rows of scales 4 between L.l. and V. *platæ*.
mouth directed obliquely downward and forward, lower jaw shorter;
series of scales 5 from L.l. to D. . *nasutus*.

(*Anostomus*.)

ANOSTOMUS SALMONEUS Gron.

Without a specimen of this species at hand it is not possible to give the characters of the teeth, these having been unnoticed by previous writers. If they agree with those of the following species, as may be expected, the crenulation will be added to the distinguishing characteristics in the diagnosis of the subgenus.

ANOSTOMUS TRIMACULATUS Kn.; Gth.

Mouth directed upward; snout elongate, nearly round in transverse section in front of the eyes, about twice the length of the eye; teeth crenulate in both jaws. The formula as taken from a specimen from Gurupa is D. 12

(13), A. 11, L.l. 45, L. tr. $\frac{6}{5\,(7)}$. Between the lateral line and the first ray of the dorsal there are six series, and between the line and that of the ventral but five entire series, or seven between the line and the median row of the belly. The depth of the body is three and three-fourths, and the length of the head four and one-fourth times in the total length, excluding the caudal. In the length of the head the diameter of the eye is contained four and one-half times. The fifth, or the sixth, ray of the dorsal is over the middle of the length of the body. A spot is present on the flank below the dorsal, another is seen at the base of the caudal, and there are faint indications of narrow transverse bands on the back, from the occiput to the end of the dorsal fin. Opercle unspotted.

(*Schizodontopsis.*)

ANOSTOMUS TÆNIATUS Kn.; Gth.

In all the species of this group the mouth opens obliquely upward and forward, the snout is broad in front of the eyes, and the teeth of the lower jaws are truncate or nearly entire on their cutting edges. On this species there are five series of scales between the lateral line and the dorsal, and four from the line to the ventral or five to the median series of the belly. One specimen, from Lake Hyanuary, has but four series between the line and the ventrals; in other respects it is normal and agrees with its fellows of the same locality. There are eight rays of the dorsal in front of the middle of the body. Depth of body and length of head are equal and each is contained four and three-fourths times in the length of the body.

Numerous examples from Cudajas, Içá, Jutahy, Lago Alexo, Lake Hyanuary, and Lake Saraca.

Anostomus proximus sp. n.

D. 12–13; A. 10–11; V. 9; L.l. 45; L. tr. $\frac{6}{5\,(6)}$.

Rather more stout than the preceding, but similar in general outline and markings. Mouth opening obliquely upward and forward, lower jaw longer, lower teeth truncate, upper crenulate. Snout about one and one-fifth times as long as the eye. Length of head and depth of body nearly equal, about two-ninths of the total length, without the caudal. The eighth ray of the dorsal is close upon the middle of the length. The row of scales from the first ray of the ventral toward the dorsal strikes the hindmost ray of the latter.

Brownish, rather dark, with a band of darker from snout to tail below the lateral line.

Closely allied to *A. tæniatus* from which it may be distinguished by the smaller, more numerous scales.

Hab. Villa Bella and Ueranduba.

Anostomus varius sp. n.

D. 12–13; A. 11–12; L.l. 45–48; L. tr. $\frac{6}{5\,(6)}$.

Depth of body, or length of head, contained four and one-third times in the length, without caudal. Much stouter than *A. tæniatus* of the same length. Mouth opening obliquely upward and forward, eight teeth in each jaw, upper crenulate, lower truncate. Back brownish, centers of scales lighter and silvery, belly silvery. A brownish band from snout to tail, below the lateral line, ending in a black spot. The band is rather indistinct, and often obsolete. On the flank there is a transverse band of brownish behind the base of the pectoral, a second from base of dorsal to that of ventral, a third behind the dorsal, and a fourth in front of the soft dorsal. The color is us-

ually darker at the points of intersection of the longitudinal and the transverse bands. The latter are frequently indistinct, even on very young specimens. On large ones the depth is less than four and the head rather more than four and a half times in the total length, and the markings are greatly faded; some have the longitudinal bands more distinct, others the transverse, and on a few all of the bands, including the caudal spot, are obsolete. Eight or nine of the dorsal rays are in front of the middle of the length. The peculiar coloration, squamation, and stouter form serve to distinguish this fish from either of the two preceding species of this subgenus.

Hab. Gurupa, José Fernandez, Lake Hyanuary, Manaos, Obydos, Porto do Moz, Rio Negro.

Anostomus nitens.

A. varius, var. n.

This name is given to a dozen light colored specimens from Içá. The transverse bands of the flank are reduced to blotches on the lateral line, the longitudinal line is faint or absent, and the general appearance is greyish rather than brown. The back is crossed by numerous narrow streaks, twenty-eight on one specimen, separated by lighter spaces of equal width. The lateral series of blotches is present on eight of the lot, while on the other four they are obsolete, excepting the caudal spot which is much faded. The eye is large, equal to three-elevenths of the length of the head, or to the length of the snout. Nine rays of the dorsal appear in front of the middle of the length.

Anostomus orinocensis St.

In the description of this fish it is said there are seven scales between the lateral line and the dorsal, and three and a half between the line and the ventral; the latter

statement is probably a mistake, since in the figure given there are six. The species is nearer to *proximus* and *varius* than to *tæniatus*.

(*Schizodon.*)

ANOSTOMUS VITTATUS C.V.; Gth.

D. 12; A. 11; L.l. 44; L. tr. $\frac{4}{4\,(5)}$.

This species is closely allied to *A. fasciatus*. It is a trifle less slender. The general appearance is darker; of the bands across the flank the three anterior occupy the same positions, but the fourth has given place to a longitudinal band extending back to include the caudal spot. The snout is one and a half times the diameter of the eye. In the length of the body, without the caudal, the depth is contained three and four-fifths times, or the length of the head four and two-thirds times. The middle of the length is below the ninth dorsal ray. The mouth opens forward. The jaws are equal, and the teeth are crenulate in both.

Hab. Porto do Moz; Goyaz.

ANOSTOMUS FASCIATUS Sp. and Ag.; Gth.

This species is very close to the preceding. Aside from being more slender, the main dependence in distinguishing it is to be placed on the coloration, as the formula is about the same for each. The tenth ray of the dorsal is nearly over the middle of the length, in which the depth is contained four and one-third and the length of the head four and two-thirds times. The mouth opens forward, the jaws are nearly equal, and the teeth are crenulate in upper and lower. The snout is about one and one-fourth times the diameter of the eye. Collected at Coary, Dutch Guiana, Hyavary, Iça, José Fernandez, Jutahy, Lago Alexo,

Lake Hyanuary, Lake Saraca, Manacapouru, Manaos, Obydos, Rio Puty, San Paolo, Serpa, Tabatinga, Teffé, Tonantins, Villa Bella.

ANOSTOMUS DISSIMILIS, sp. n.

D. 12; A. 11; V. 9; L.l. 43–45; L. tr. $\frac{4}{4\,(5)}$.

Nearly related to both of the preceding. Darker in color than *A. fasciatus*, and distinguished from it, as from *A. vittatus*, by the absence of a spot on the base of the tail. The blotches on the flanks vary greatly, being reduced, irregular, faint, or entirely absent. Length of head equal to the depth of body and contained in total length, without caudal, four and two-thirds times. The mouth opens forward, the lower jaw is very little the longer, the teeth are all crenulated. Twelve specimens from the Rio Puty.

ANOSTOMUS ISOGNATHUS Kn.; Gth.

A. Knerii St.

The lateral band, figured by Kner, appears to be quite variable. Specimens from the Velhas show it still further reduced than in the form figured as *A. Knerii*, it being simply a black spot at the base of the caudal with faint indications of continuation forward and backward. There are five entire series between the lateral line and the ventral, or seven between the line and the median ventral series. Mouth directed forward, jaws nearly equal, teeth crenulate in the upper and lower. Snout about one and one-half times as long as the eye. Depth three and two-thirds and length of head four and one-fourth times in the total length, without caudal. The row of scales from the first ray of the ventral toward the hinder part of the dorsal passes entirely behind the latter.

ANOSTOMUS PLATÆ, sp. n.

D. 12; A. 11; V. 9; L.l. 45; L. tr. $\frac{6}{4(5)}$.

Mouth opening forward, lower jaw a little longer, teeth crenulate in both jaws. Length of snout equal to that of the eye. Depth of body three and one-half, or length of head four and two-thirds times in the total length, without the caudal. The ninth ray of the dorsal fin is over the middle of the length. The row of scales from the first ray of the ventral toward the hinder part of the dorsal leads to the third ray from the end of the latter. There are six rows of scales between the lateral line and the dorsal and four between the line and the first ray of the ventral or five from the line to the median ventral series. This species is stouter in front of the dorsal and more decurved about the occiput than *A. isognathus;* it has larger scales and a smaller number of rows on the ventral region.

Color silvery, back darker, with lighter streak on the middle of each scale; a faint spot at base of caudal.

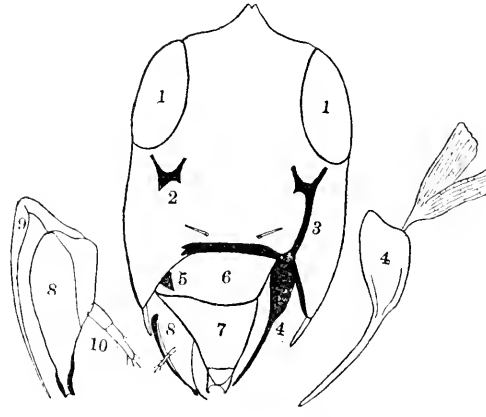
Hab. Rosario, La Plata.

ANOSTOMUS NASUTUS Kn.; Gth.

Mouth opening obliquely downward and forward, lower jaw shorter, teeth crenulate in upper and lower. Six series of scales between the lateral line and the dorsal, five between the line and the ventral, and seven between the line and the median row of the belly. From the darker lateral edges of the scales, the body has the appearance of being longitudinally streaked with dark. The caudal spot fades out gradually forward as in *A. isognathus*. Fifteen specimens from the Rio Puty.

THE MOUTH-PARTS OF THE THYSANOPTERA.

BY H. GARMAN.



EXPLANATION OF FIGURE.

Front (ventral) view of the head of *Limothrips cerealium* Haliday (to some extent diagrammatic). 1, compound eyes; 2, radiating part of endocranium at base of right eye; 3, bar which connects the same of left side with edge of epicranium; 4, mandible of left side, represented more enlarged at right of figure; 5, rudimentary mandible? of right side; 6, clypeus; 7, labrum; 8, galea? of maxilla; 9, lacinia? of maxilla; 10, maxillary palpus.

For some time the writer has been familiar with a peculiarity in the mouth-parts of members of this group of insects which is without a parallel among other insects known to him, and is so extraordinary that some hesitation is

felt about calling attention to it. After verifying observations again and again on several species of two genera, by dissection and other means, I am persuaded to publish a brief notice of it in the hope of getting further light, and also with a view to learning how general the peculiarity referred to is for the group, a matter which I am not able to decide from the material now in my possession.

The statements generally made with reference to the structure of the mouth are, that it is fitted for taking liquid food; that the mandibles are long, slender, styliform, and slightly swollen at the base; that the maxillæ are triangular (in outline), pointed, and bear palpi; and that the labrum and the labium are well developed, the latter with palpi.

In all the examples of the order which I have examined, the labium, with palpi of two segments, agreed closely with the published descriptions and figures.

The triangular parts (the maxillæ of authors), each with a palpus, sometimes of two, sometimes of three segments, have been easily recognized from the descriptions, but instead of being pointed they are slightly swollen at the tip, and the margins there project above one surface as chitinous rims, leaving a groove between them.

The labrum, in the species dissected, is not a symmetrical organ, but its two sides are quite different in shape.

On the right side its lateral margin is the more oblique relative to the middle line, and it extends consequently farther out on this side at its base. The lateral margin of the left side is more nearly parallel with the middle line, and the labrum does not extend so far out at the base. Otherwise the labrum agrees with published descriptions.

In every example dissected there is at the left of the labrum, and apparently articulating with the epicranium,

a well-developed chitinous organ, with a swollen base and a spine-like distal portion, which latter, when the organ is in position, passes through a sort of loop in the distal extremity of the one-sided labrum. Nothing corresponding to this conspicuous organ is apparent on the right side of the head, unless a very small chitinous structure under the edge of the clypeus is a rudiment of the organ for this side.

The asymmetry extends also to the chitinous endocranium of the head. Through the epicranium, when this has been rendered transparent, a dark bar of chitin may be seen on the left side extending from the thickened rim of the epicranium, at the outer edge of the clypeus, anteriorly nearly to the base of the compound eye of this side where it meets several converging bars, a slender one of which extends from the base of the left antenna along the inside of the eye. On the right side, the bar corresponding to that first-mentioned is not present, and the chitinous rim of the epicranium, even, appears to be here imperfect. The radiating part of the endocranium near the base of the right eye is, however, as easily made out as that on the left side, the bar alone, connecting it with the edge of the epicranium, being wanting.

What is this jaw-like organ, and why should it be developed on one side and not on the other? To the second of these questions I have no reply to make further than to suggest that it may be a case of asymmetry like that of the lungs and ovaries of serpents,—a sacrifice of one of a pair of organs for a gain in slenderness. To the first, I am compelled to reply that the organ has every appearance of being a mandible. Its form and its relations to the other mouth-parts, and to the epicranium, all indicate this. It is well supplied with muscles. It consists of a single piece.

But if this is a mandible, what are the styliform organs which have always been considered the mandibles of Thysanoptera? Two symmetrically developed organs of this kind are always present. They do not, however, consist of one chitinous segment, as commonly represented, but the styliform portion is articulated (movably, I think) at its base with a shorter piece, which by ordinary dissection comes free with the other. In dissections made with greater care these basal pieces are seen to be joined to the bases of the palpus-bearing triangular parts. It seems probable therefore that the styliform organs are lobes of the maxillæ, and that the triangular organs are also lobes of the same. The fact that the palpi are borne upon the triangular parts would indicate that these latter were the galeæ, and the more slender ones were laciniæ. But I am not satisfied with my examination of these parts, and do not wish to insist at present on more than the probability that they are lobes of the maxillæ. In position, the styliform parts lie above or below the palpus-bearing pieces, according to the side from which they are seen, and their distal portions pass between the rims at the ends of the latter. When dissected free from the other mouth-parts, and placed under a cover glass, they appear as represented in the figure, the slender pieces being pressed to the outside.

A NEW FRESH-WATER CRUSTACEAN.

BY H. GARMAN.

MANCASELLUS MACROURUS, n. sp.—Outline seen from above elongate oval, a trifle widest posteriorly. Terga convex, with an obtuse median ridge. Head excavated in front, with a slight median tooth, and a blunt prominence on each side midway between this and the lateral margin. A deep cleft in the expanded lateral portion of the head separates from the rest a posterior lobe on each side. Eyes opposite these clefts, rounded, prominent. Lateral edges of all the body segments behind the head rounded. Posterior segment very large and wide, a trifle hollowed out above the insertion of the caudal appendages. Most of the segments roughened on each side of the median ridge, all broadly explanate at the sides. Upper antennæ small, about as long as the first four articles of the second pair; composed of nine segments, the first large, globose, short; the second cylindrical, about as long as the three following together; third about twice as long as the fourth, remainder subequal. Second antennæ reaching the posterior margin of the fifth body segment when drawn back; pedicel composed of five segments, of which the first three are short, and the remaining two, long and cylindrical; flagellum swollen at base. Mandibles without palpi. First pair of legs of male with hand greatly swollen, oval, shin-

ing, white, mottled with brown. Palmar margin of hand strongly angulate near the base, the angle preceded by about five short spines. Between the angle and the dactyl is a large, sharp tooth-like projection. Dactyl with minute appressed spines on the inner edge, terminating in a small claw. First genital plates of male with the quadrate basal segment about equal in length to the greatest width of the lance-shaped distal segment. Second pair of genital plates of male with proximal segments about as wide as long; distal segment of outer ramus fringed with long hairs, obliquely truncate. Caudal appendages of adults rather large; the pedicel slightly excavate at middle of its inner margin, about two and a half times as long as wide; outer ramus about three-fourths the length of the inner ramus.

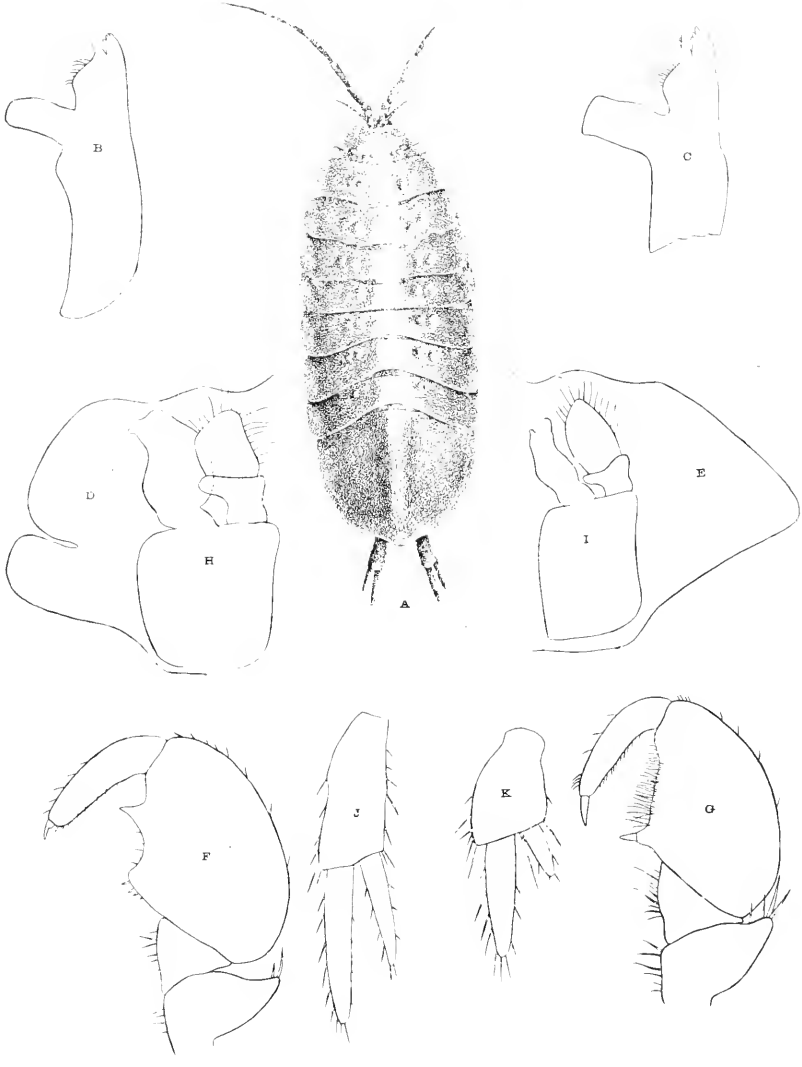
Length of adult males .63 inch; width .25 inch; lower antennæ, .38 inch. Length of adult females .44 inch.

A large and abundant crustacean in springs and spring-fed rivulets and ponds in eastern Kentucky. Large examples are of a dull gray color with the expanded lateral portions of the head and body-segments paler. In young the contrast between the central and lateral portions of segments is more decided, and two longitudinal dusky bands appear on each side, one just outside of the median ridge, and the other just within the expanded lateral portions of the segments.

The species is closely related to the Virginian *Mancasellus brachyurus*, but may be distinguished at once by the fissured lateral portion of the head, and by the greater length and different shape of the caudal appendages. Other differences equally important with these become apparent under the microscope, as will be seen by comparing the accompanying figures.

EXPLANATION OF THE FIGURES.

A. Dorsal view of *M. macrourus*, n. sp.
B. Mandible " " "
C. " " *M. brachyurus.*
D. Outline of one side of head of *M. macrourus.*
E. " " " " " " " *M. brachyurus.*
F. Hand of *M. macrourus.*
G. " " *brachyurus.*
H. One of second genital plates of male *M. macrourus.*
I. " " " " " " " *M. brachyurus.*
J. Caudal appendage of *M. macrourus.*
K. " " " *M. brachyurus.*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THE STRATIFIED ROCKS OF ESSEX COUNTY.

BY JOHN H. SEARS.

THE term "stratified rock" is applied to different rock formations in which stratification is the only common character, and although the syenites, diorite, felsites and some of the so-called breccias show stratification in part, there is little difficulty in separating them from the groups consisting chiefly of limestones, quartzites and argillaceous rocks of which this paper treats.

Nearly one-half of the bed rock of Essex County is distinctly stratified, and by means of our knowledge of these groups the geologic age of all the other rock masses may be approximated.

When we consider the frequent faulting of the rock formations and the great area which is covered by drift sand, gravel, clay and till, leaving only occasional outcrops for examination, the difficulty of preparing a correct map of the underlying rocks of the county may readily be seen.

The stratified rocks of the county which are here to be considered are divided into several groups. The principal ones are the limestones, argillites, quartzites, and shales of detrital origin, and the schists, amphibole and granitic gneisses of doubtful derivation; the whole to be classed as more or less metamorphic, a condition clearly revealed by the microscope when these rocks are studied in thin section. The effects of metamorphism on rocks are consolidation, loss of material by chemical solvents, change of

color, obliteration of fossils, and crystallization, with or without change in the constituent minerals of the rock. As examples: by metamorphism, zoisite, glaucophane, chlorite, leucoxene, epidote, etc., are formed as new minerals, while secondary formations of quartz, glassy feldspar, calcite and epidote are often seen. Brown hornblende is altered to green hornblende, augite to hornblende and magnetite, biotite to green chlorite and magnetite, besides other important changes.

Among the most interesting of the stratified rocks are the Nahant[1] limestones; they are first seen on the south side of Nahant Head at the Shag rocks and extend about three hundred yards to a point just beyond Bennett's Head on the north. The limestones are much metamorphosed into bands of light and dark lydite, microscopic sections of which reveal calcite, quartz grains, magnetite and mica, with occasional masses of nearly pure calcite interstratified with an indurated quartziferous slate. In thin sections under the microscope they are shown to be composed of calcite, epidote, quartz, serpentine, white garnets and limonite; chlorite tinges portions of the rock green, while hematite and limonite turn other parts red, thus giving the mass a brightly banded appearance, its most striking feature to casual visitors. By means of certain fossils which have been found in this rock the horizon of its formation is determined as the Olenellus, Lower Cambrian. Mr. Auguste F. Foerste first described one of these fossils (*Hyolithes inæquilateralis*, sp. nov.) in the Proc. of the Boston Society of Natural History, Vol. 24, p. 262, and I have since collected from the region numerous specimens of this species and also of *Hyolithes princeps*, *Hyolithes communis*, var. *emonsii*, *Hyolithes impar* and *Stenotheca rugosa;* all of

[1] A paper on the Geology of Nahant by A. C. Lane, will be found in the Proc. Boston Soc. Nat. Hist., Vol. XXIV, p. 91.

which have been identified by Mr. Charles D. Walcott of the United States Geological Survey, Washington, D. C.

The strike of this limestone is 18° north of east, the dip 40°–43° west.

In the month of July, 1890, I discovered an outcrop of this Olenellus limestone in a valley between Prospect Hill and Hunslow's Hill in Rowley. It has nearly all become altered to chert and epidote, but fragments of the Hyolithes fossils are still to be found in it.

This outcrop dips under a red sandstone which in turn is covered with the fine grained granitic gneiss of the region. The strike of this newly discovered outcrop corresponds very nearly with that of the Nahant rock of similar character, and is 20° north of east with a dip 45° west. A mass of diorite, known as Metcalf's rock, cuts across this limestone on the southeast near the Ipswich line and on the north it is covered by the banded red felsites of Byfield.

Near Bennett's Head, Nahant, the strike of this limestone is 20° west of north, dip 45° southeast. Here the limestone rock mass has been turned or pushed one side by the intrusion of a massive dyke of very unusual character, and which under the microscope in thin section is seen to be composed of hypersthene, olivine somewhat serpentinized, diallage, plagioclase, biotite, numerous brown zircons, magnetite, a little calcite and brown hornblende.

At a short distance north of Bennett's Head, Nahant, there is exposed at low tide a metamorphic schist having a strike northeast to southwest. It is again seen at Bass Point in the southwest part of the town. The microscopic structure of this schist in thin section is: grains of quartz, some feldspar in bands alternating with dark bands composed of grains of quartz, grains of magnetite in large amount, flakes of biotite, some flakes of chlorite, muscovite

and a large amount of grains of a slightly greenish tinge, giving, with the polariscope, quite high single refraction and often showing a rectangular prismatic outline; parallel extinction commonly giving an aggregate fibrous polarization; these grains may be andalusite decomposed to muscovite aggregates.

On the southeast side of Nahant Head, dipping under the banded limestones, is a typical argellite slate; microscopic examination shows an abundance of muscovite, numerous quartz grains with fluid and microlithic inclusions, some of the quartz grains showing the incipient cracks and partings due to crushing, well rounded grains of plagioclase probably derived from some gneissic formation, with quartz and numerous microlithic inclusions. The ground-mass is composed of earthy kaolin and fibrous chlorite and embedded in it are numerous cubical iron pyrite crystals. This slate is again seen on the north side of little Nahant where it is interstratified with a coarse mica schist containing much quartz, some of which is of clastic origin and still shows the grains of original quartz sand.

The nearest bed of metamorphic sedimentary rock is the outcrop near Flying Point, Marblehead Neck. This rock-mass is now a mica schist and is probably a metamorphosed slate; it is cut and greatly distorted by the eruptive granite. The microscopic structure of this rock-mass as shown by several thin sections that I have prepared is as follows: several grains of microcline well twinned with numerous inclusions of micro-zircons, orthoclase much kaolinized, earthy quartz in angular and rounded grains, some crushed and broken and many showing incipient cracks due no doubt to local metamorphism, much muscovite and biotite lying in the plane of the schistosity, a few grains of epidote, fragments of white garnets and numerous large patches of red garnets which are much broken and crushed,

an abundance of magnetite and some limonite. The disintegration of this rock produces the magnetite and garnet sand of the region. The mica schist of Naugus Head, Marblehead, and Woodbury's Point, Beverly, probably belong to this metamorphic slate although the metamorphism is more complete; for, in these last named outcrops, the schist is not only cut by the granite but it is also cut by the diorite, elæolite zircon syenite, felsite and diabase dykes, thus making the metamorphism of the rock-mass most intricate; indeed, as pointed out by Dr. M. E. Wadsworth, the elæolite zircon syenite has been injected in large sheets into these schists, in the planes of the schistosity and jointings of this rock, to such an extent that in some places it is puzzling to decide which is syenite and which is mica schist.

Microscopical examination shows this schist to be composed of a few grains of clastic quartz sand, much secondary quartz, secondary glassy feldspars, some muscovite, an abundance of biotite which is probably secondary, a few grains of epidote, apatite as inclusions in the ground-mass which is feebly polarizing earthy kaolin, much magnetite, red garnets and micro-zircons.

In Middleton, half a mile southeast of the village, near the house of Mr. J. U. Parker, is a well preserved clastic shale approaching a sandstone. This outcrop shows a strike nearly northeast to southwest with the dip 50° north of west; it is again seen in an outcrop in the rear or west side of the barn of Mr. Francis Peabody near the Ipswich river on the north side of the village. The microscopic structure of this shale is: angular and rounded grains of quartz which show embryonic cracks and much crushing and in some grains a secondary enlargement, plagioclase twinned feldspars broken and crushed, some of which are in well-rounded grains; ground-mass an earthy kaolin with plates of bi-

otite, some muscovite and an abundance of magnetite in the planes of the schistosity of the shale, fine inclusions of micro-zircons are seen in the kaolinized feldspars. Some of the dark opaque patches resemble lignite and it is not impossible that this shale is carboniferous, although it requires more field work and lithological study to prove it.

In the line of the strike to the northeast, across the Ipswich river in Topsfield, on the land of Mr. Peterson, two hundred yards northwest of the old Endicott copper mine, this shale, which is here a dull red color, protrudes in several places. It is interstratified with a ferruginous sandstone; the strike remains constant, northeast to southwest with the dip 50° west. The microscopic structure of thin sections from the outcrop near the roadside is as follows: section cut across the bedding, ground-mass of earthy kaolin much discolored with a ferruginous iron oxide, magnetic titanic iron, some leucoxene, original quartz grains showing secondary enlargements, incipient cracks and broken grains and also fluid inclusions, some feldspars much decomposed, muscovite scales, green chlorite, apatite, numerous microliths and zircons, a few grains of zoisite and epidote. A strongly developed shearing to the north accounts for the crushed and broken appearance of the quartz and feldspar grains. Section across the bedding from a specimen of the outcrop in the field on the opposite side of the road, near the dwelling house of Mr. Peterson: ground-mass composed of earthy kaolin and fibrous chlorite, magnetite, titaniferous iron surrounded by leucoxene, micro-zircons, apatite, numerous microliths so small that they cannot be determined with the highest power of the microscope, quartz grains with numerous fluid inclusions, muscovite and a few grains of zoisite are arranged parallel to the bedding. Ferruginous sandstone from Peterson's land, Topsfield (Sec. 81): ground-mass of

quartz and feldspar grains, numerous flakes of muscovite with detrital angular fragments and pebbles of the quartz, feldspars colored with ferreous oxide, some epidote and chlorite and threads of calcite.

Continuing on the strike of this shale, there are two outcrops in the northeastern part of Topsfield, one in Linebrook, a parish of Ipswich on Bull Brook, one in Rowley near John Dodge's mill and another near tide water between Ipswich Village and Rowley. The microscopic structure of the sections from specimens in the cabinet of the Peabody Academy of Science from these localities is nearly the same as that of the last two from Topsfield. Other outcrops of these clastic shales are frequent in the northern part of the county. There is on the south bank of the Merrimac near the Artichoke river, a large area of this shale much crumpled and distorted with the strike north and south and dip vertical. Near the point where Indian river empties into the Merrimac the shales are continuous for three hundred yards, and from Bradford across North Andover and South Lawrence, in a southwest course, they can be traced in an almost unbroken line to West Andover. On this strike the shales are bedded between the granite gneisses on the south and the metamorphic slates on the north.

At North Saugus, near the corner of Main and Oak streets, is an outcrop of metamorphic slate interstratified with a quartzite, and on Main street two hundred yards east of the school house the hornblendic eruptive granite cuts directly across this metamorphic slate and includes large fragments of it. The strike of these metamorphic slates and quartzites is north 20° E. parallel to that of similar beds at Lynnfield Centre. The microscopic structure of this metamorphic slate is: clastic quartz grains with many fluid inclusions, well-rounded grains of plagioclase, orthoclase

almost entirely decomposed, biotite, some muscovite, and magnetite, ground-mass, a ferruginous earthy kaolin with some fibrous chlorite and a few grains of epidote.

The quartzite from the same place in thin section shows: quartz grains with numerous fluid inclusions, feldspars much kaolinized and containing numerous inclusions of apatite, tourmaline and epidote, while patches of chlorite are often seen in the line of the bedding; the whole rock mass is thoroughly saturated with a ferruginous limonite giving it a dirty yellowish color. The microscopic structure of the quartzite from Lynnfield Centre is: quartz grains containing numerous fluid inclusions and incipient cracks, also crushed and broken grains produced by pressure in the rock-mass during metamorphism, much secondary quartz which, with the polariscope, gives the usual wavy extinctions, some grains of secondary glassy plagioclase, perfectly fresh grains of microcline, orthoclase kaolinized and much decomposed, with numerous inclusions of zircons and apatite crystals, some chlorite and a little biotite. This outcrop is exposed for a distance of one hundred yards and is in some places finely schistose and laminated, while in others it is massive; the strike is north 20° east, dip 50° west.

Nearly all of the bed rock of West Newbury, Groveland, Haverhill, Bradford, Lawrence and Methuen is composed of metamorphic slate. The microscopic structure of a specimen of this rock from Ward's Hill, Bradford, section cut across the bedding, is largely of detrital grains and angular fragments of quartz, many of which are crushed and broken, orthoclase grains nearly all kaolinized and earthy, biotite mica abundant in the planes of the schistosity, some original muscovite, microscopic zircons, rutile and titanic iron. A section parallel to the bedding shows large masses of chlorite developed as a product of decomposition of the biotite and inclusions of apatite crystals are abundant.

The microscopic structure as shown by five sections of this metamorphic slate from East Haverhill is: angular and rounded grains of quartz in some of which there are numerous fluid inclusions, several quartz grains in the line of the schistosity of the rock-mass showing cracks from all the incipient stages to the broken and crushed masses, feldspar grains much kaolinized and showing the effect of crushing, some of the grains being broken into several pieces, scales of muscovite and biotite arranged in layers parallel to the schistosity of the rock-mass and inclusions of apatite, zircons, fibriolite and rutile abundant in the kaolinized feldspars. Titaniferous magnetite and leucoxene are scattered through the sections and fine acute rhombs and long lath-shaped sections of titanite are seen in one of the thin sections.

The microscopic structure of the metamorphic slate in the bed of the Merrimac river below the Lawrence dam is: clastic grains of quartz sand, some secondary quartz surrounded with earthy yellowish kaolin and chlorite masses, titaniferous magnetite and leucoxene and a few grains of plagioclase with inclusions of apatite, zircons and fibrolite.

The quartz grains show evidence of crushing, embryonic cracks are developed and some of the grains are broken and the pieces faulted two and in one instance three times.

Nearly all of the bed rock of Methuen is composed of this metamorphic slate and a coarse mica schist of the same composition as that from Lawrence, Haverhill and Gage's Hill in Bradford. In Methuen this slate and schist is over one thousand feet in thickness; the trend is north 40° east southwest, dip 45° west. Nearly every outcrop from West Andover across Lawrence, Methuen, Bradford, Haverhill, Merrimac, South Hampton, Hampton Falls and North Hampton to Rye in this strike is composed of these same metamorphic slates and schists.

On Kent's Island in Newbury, at the junction of Little and Parker rivers, there is a bed of argillite interstratified with sandstone which extends about one thousand yards on the bank of the Parker river to a point near the Eastern Railroad and on Little river one hundred yards west. Some of the beds are of a dull red color resembling the North Attleboro and North Weymouth slates while others are of a greenish color. They are cut in several directions and are distorted by felsites and amygdaloidal melaphyrs, shearing and faulting to such an extent that the true bedding is quite difficult to determine. By uncovering the glaciated surface, however, and washing away the clay and drift the bedding is plainly revealed. The strike is 50° north of east, dip 55° southwest. The microscopic structure of a very opaque section of the red slate, cut across the bedding is: clastic quartz grains and fragments showing secondary enlargement and crushing and containing numerous fluid inclusions, surrounded by a ground-mass of earthy kaolin, much muscovite and ferruginous magnetite and limonite. The sections of the green slate from Little river are composed of angular and rounded quartz grains, a finely fibrous kaolinized ground-mass, some epidote, muscovite, a few grains of zoisite and much chlorite. The alternating sandstone is composed of quartz and feldspar grains, some biotite and scales of muscovite and much ferretic oxide.

In Andover, near Butterfield's saw mill, is an outcrop of metamorphic micaceous sandstone lying parallel to the hornblende schist on the east; this formation is again found at John Jenkins' farm near the cross road to Ballard Vale. The microscopic structure of sections from these outcrops is: quartz grains of original sand cemented by a film of ferreous oxide and some secondary quartz, scales of muscovite and biotite and masses of fibriolite. One of the sections

from the last-named outcrop is composed of quartz grains and angular fragments with numerous fluid inclusions showing incipient cracks and broken grains, much muscovite, some biotite, magnetite, chlorite and epidote.

Another large area of the metamorphic slate, interstratified with sandstone, first seen near a small pond in South Groveland, is nearly continuous from Johnson's pond in West Boxford to the north side of Chadwick's pond in Bradford and forms all the adjoining outcrops for nearly two miles in North Andover. The microscopic structure shown by several sections is :well rounded original grains of quartz and plagioclase, biotite, muscovite, a little chlorite cemented by a thin film of secondary quartz and ferreous oxide. One of the sections contains magnetite and limonite. The sandstone is composed of nearly pure quartz sand cemented by some secondary quartz and a fibrous feebly polarizing felspathic mass ; fluid inclusions in which the bubble movement is quite active are frequent in the quartz grains. In a cutting of the Boston and Maine Railroad just north of Reading, Middlesex county, is a fine exposure of hornblendic gneiss showing great variety. Succeeding this on the west are sandstones, diorites, coarse granitic gneisses and eruptive granite dykes; on the east are the eruptive hornblendic granites and crystalline gneisses of Middleton. The strike of the whole series is north 40° east, dip varying from 30° north of west to 90°.

Following the strike of the hornblendic gneisses into Essex county there are outcrops in various places near Foster's pond, Andover, and on the roadside, in a cutting near the John Jenkins farm, there is an exceptionally good exposure where this gneiss is seen for several rods with the same strike with the dip slightly to the west. Continuing, numerous exposures are seen in Farnamville, North Andover, at Marble Ridge near the railway station, on both sides

of Andover great pond, across West Boxford to Chadwick's pond and throughout the entire region between Chadwick's and Stiles' pond. Here observation is interrupted by numerous drift hills; but, beyond, on the same strike we find numerous outcrops in Georgetown, on both sides of Gravelly pond, and in Byfield and the Newbury mining region where there are several good exposures; also on the Smith mining lands in Newbury where it forms all the bed rock exposed; it is last seen at Black Rocks, East Salisbury. In some places this gneiss is but a few rods wide while in others it enlarges to nearly a mile in width.

There are also several areas of this rock to the north and south of this line of strike. One in North Andover near Mr. Lacy's farm on the road to East Boxford covers several acres, lying between the metamorphic slate on the north and a crystalline gneiss at the south. This formation extends into East Boxford and forms the famous Crooked pond outcrop which is nearly half a mile wide and can be traced by lesser outcrops to Chaplinville, Rowley, a distance of six miles.

Twenty microscopic sections of the metamorphic hornblende epidote gneiss taken from every outcrop in the strike from North Reading to Black Rock, Salisbury Beach, give the structure as follows: section across the bedding of specimen from the John Jenkins farm, Andover; brown hornblende allied to green hornblende, magnetite, plagioclase with numerous inclusions of quartz, biotite flakes and masses in the plane of bedding, numerous quartz grains, many of them well rounded and containing numerous fluid inclusions, some patches of chlorite, numerous grains of epidote, a little sahalite and large masses of zoisite.

Section across the bedding of specimen from east of the Lacy farm, North Andover: green hornblende with epidote inclusions, much biotite, quartz grains and patches of

secondary quartz, some plagioclase deeply kaolinized, ground-mass of kaolinite, epidote and magnetite and some zoisite in the plane of the bedding. Specimen (fibrolite gneiss) collected at Marble Ridge, south of the railroad station: quartz, plagioclase and orthoclase feldspars in grains, large flakes of muscovite, biotite, and acicular crystals of fibrolite, in aggregates, scattered through all the minerals; the plagioclase has numerous inclusions of quartz and the biotite inclusions of zircons and garnets which show fine pleochroic halos. In the ground-mass are patches that strongly resemble corderite, but so much altered that determination is difficult. In hand specimens this rock is nearly identical to the genuine corderite gneiss.

Hornblende epidote gneiss from Crooked pond, East Boxford; section across the bedding, microscopic structure: green hornblende, twinned feldspar with numerous inclusions of quartz grains, patches of quartz in which there are numerous fluid inclusions, large patches of zoisite, biotite and magnetite, numerous areas of chlorite and some epidote. Section parallel to the bedding shows the zoisite surrounding hornblende crystals and the hornblende in turn surrounding grains of magnetite, all lying in one plane across the section dependent upon one plane of pressure. Titanic iron surrounded with leucoxene is abundant in this section. Specimen from east of Chadwick's pond: quartz grains, apparently detrital, with numerous fluid inclusions, much biotite, some plagioclase with inclusions of quartz, some chlorite and magnetite. This may be termed a biotite schist. Metamorphic hornblende epidote gneiss from Smith Mine, Newbury. Microscopic structure of section across the bedding: green hornblende with numerous inclusions of plagioclase and magnetite, much biotite, some muscovite, grains of quartz showing enlargement by the addition of secondary quartz, orthoclase much decom-

posed, in which there are numerous inclusions of apatite, epidote and micro-zircon crystals. The ground-mass is a feebly polarizing earthy kaolinite in which there are cubes of iron pyrite, masses of chalcopyrite and a little galenite, some zoisite masses are developed in the line of the schistosity of the rock-mass and some of the magnetite is titanic iron around which patches of leucoxene have developed. Judging from the majority of the sections studied it is probable that this gneiss is derived from an igneous rock rather than from detrital material, although some of the sections indicate the latter origin. During the mining excitement of 1875 and 1876, a boring was made through this gneiss striking limestone at a depth of fifteen hundred feet. Microscopic sections of specimens from Black Rock, East Salisbury, at the mouth of the Merrimac river, show detrital quartz grains and angular fragments, plagioclase much decomposed, numerous plates of biotite arranged parallel to the bedding, some green hornblende, epidote grains, titanic iron and leucoxene. The ground-mass is principally secondary quartz and ferrite, cementing an earthy fibrous kaolinite. With the polariscope the secondary quartz gives the usual wavy extinctions.

To the south and running parallel to this hornblende epidote gneiss is a band of thoroughly crystalline metamorphic gneiss. The finest outcrops are to be found at Middleton, Boxford, Georgetown, Byfield and the Newbury mining region. The microscopic structure of sections of specimen from Middleton (No. 18) is : quartz grains and patches, plagioclase with numerous inclusions of quartz, biotite and epidote, green hornblende with inclusions of biotite and apatite crystals, some titanite and chlorite ; ground-mass of secondary quartz and ferrite. Microscopic structure of sections from Boxford (Nos. 109, 110) : numerous quartz grains, well rounded plagioclase grains, much ortho-

clase deeply kaolinized; both the plagioclase and the orthoclase having numerous inclusions of quartz and biotite. There are also grains of epidote and fine dust-like ferrite, and muscovite plates arranged parallel to the bedding. Microscopic structure of section of specimen (No. 111) from John Noyes' Copper Mine, Newbury, closely resembles the sections from Boxford (Nos. 109, 110) excepting that there is more biotite, that numerous cubes of iron pyrite are scattered through the dust-like ferrite and that microliths are of numerous occurrence.

In the northern part of the county, occupying nearly the whole of the region known as Ballard Vale, West Andover, South Lawrence, a part of North Andover, Bradford, Haverhill at Ayer Village, and passing into New Hampshire, is a coarse granitoid gneiss cut by dykes of eruptive hornblendic granite and diorite. In Andover and North Andover the strike of this gneiss is east 40° north, parallel to the metamorphic slate, dip 35° southwest. A large area of this gneiss in West Andover and South Lawrence has been opened for quarrying purposes and fine exposures may be seen in a quarry at South Lawrence worked by Mr. Jesse Moulton. The strike at this point is east 20° north, dip 85° south of west. The microscopic structure of sections of this rock is: coarse masses of orthoclase, microcline, quartz, muscovite, garnets cemented together by a thin film of secondary quartz. Numerous inclusions of quartz, biotite and muscovite are seen in the feldspars. I have traced this gneiss by means of numerous outcrops through South Hampton, Hampton and Rye to the Isles of Shoals. At Rye an old quarry offers good facilities for study, and specimens received from Appledore Island are of the same character and show the same microscopic structure in thin section.

At Folly Point, Lanesville, and also at West Glouces-

ter, near the Loaf on Coffin's Beach, occurs a hornblendic biotite gneiss. The microscopic structure (specimens Nos. 88 and 122) : is hornblende with numerous inclusions of biotite and quartz, plagioclase grains with inclusions of quartz and apatite, magnetite, some patches of limonite, epidote, chlorite, and titanite and rutile inclusions in the ground-mass which is a fibrous earthy kaolinite.

In an economic aspect these stratified rocks possess special interest, for it is in the rocks of this class in the county that the ores of silver, lead, copper, etc., are found as shown by the results of the mining operations in the vicinity of Newbury, Georgetown and Boxford.

The transitional forms of these metamorphic schists and gneisses have not been fully studied in the field, but their occurrence in connection with the metamorphic slates and sandstones indicates that they are transitional forms of these rocks, the metamorphism being in part due to the great pressure and crushing caused by the granite and diorite masses which have been erupted through them. And, furthermore, zoisite, so far as observed, is only found in metamorphic sandstones and gneisses, except as an epigenitic constituent of eruptive rocks (Becker, Geology of the Pacific Slope, United States Geological Survey, Monog. XIII, p. 82), and zoisite is of frequent occurrence in the hornblende epidote gneiss of Essex county.

June 3, 1890.

NOTE.—On the fishing ground known as Jeffrey's Ledge, twenty miles east-northeast from Thatcher's island, at the depth of forty-five to fifty fathoms, the fishermen often pull up on their anchors and trawl lines, large masses of the Olenellus lower Cambrian chert and limestone, identical in composition with that at Nahant Head and Rowley. Jeffrey's Ledge is about forty-five miles northeast

from the Nahant locality, and east-southeast from the Rowley outcrop. I have observed for several years pieces of this rock, in a more or less decomposed state, in places in Rockport and Gloucester frequented by fishermen, but could not obtain satisfactory information as to their source; therefore, definitely locating this rock at Jeffrey's Ledge is of importance as proving the extent of the lower Cambrian deposit on the coast of Essex County, Mass. I have recently procured a fine specimen of this chert and limestone which was hauled up on a trawl line by Mr. George Parsons of Rockport; he states that the fishermen call it "horse sponge" and, as it is often perforated by numerous worm borings and covered with hydroids and algæ, it certainly resembles a calcareous sponge.

Sept., 1890.

4198.

BULLETIN

OF THE

ESSEX INSTITUTE.

VOL. 22. SALEM: APR., MAY, JUNE, 1890. NOS. 4, 5, 6.

ON A GENUS AND SPECIES OF THE CHARACINES (*Henochilus Wheatlandii*, gen. n. et sp. n.).

PLATE I.

BY S. GARMAN.

Characters.—Body oblong, compressed, covered with large scales; belly rounded; head naked. Intermaxillaries and maxillaries forming the margin of the upper jaw. A lip on the lower jaw, none on the upper. Mouth wide; teeth in each jaw strong, compressed, trenchant. Gills four, openings wide, membranes free from the isthmus and separated from each other; gill-rakers setiform; no pseudobranchiæ. Nasal openings close together. Dorsal fin placed nearly in the middle of the body, near a vertical from the ventrals; anal long; caudal deeply notched. Lateral line continuous.

DESCRIPTION.

Br. 4–5; D. 11; A. 26; V. 8; P. 14; C. $\frac{13}{11}$; L. l. 47; L. tr. $\frac{8}{4\text{-}5}$. In shape this fish resembles the common carp, or some of the stouter forms of the species of Cor-

egonus; the body is deep and moderately thick, strongly arched behind the head and rounded on the belly. The head is rather small, about one-sixth of the total length, including the caudal fin, or a little more than half of the depth; it is quite naked and approaches the subconical in its outlines, but is blunt and rounded on the snout; across the interorbital space it is strongly arched. Snout broad, nearly twice as long as the orbit, rounded. Nostrils close together, separated by a valvular fold of the skin; posterior larger, subtriangular; anterior much smaller, circular, nearer to the eye than to the end of the snout. The orbit measures about one-fifth of the length of the head, or two-fifths of the interorbital space. Mouth wide, extending almost as far back as the middle of the eye, without an upper lip, with a well developed lower lip.

Teeth broad, compressed to a sharp edge, which is rounded on the summit. At each side of the rounded or spatulate cutting portion of each tooth, near its base, there are two small denticles or cusps, the upper of which is the sharper. As the teeth are imbricated in the series, in such a way that the outer (hinder) edge of each lies outside of the next following, only the posterior pair of the denticles of a tooth are visible from without, the anterior pair being hidden by the tooth immediately preceding in the row. On mandibles, intermaxillaries and maxillaries the teeth are alike. Those on the latter occupy more than the half of its length and extend almost to a vertical from the middle of the eye; they with those of the intermaxillary form a continuous and regular series. On the intermaxillary close behind the middle, there is a short series of three (four) smaller teeth of similar shape. The maxillary is firmly connected with the intermaxillary and at the hinder end of the dental series becomes narrower and bends downward abruptly. At the symphysis behind the

mandibular series there are two small teeth with sharp cusps that curve backward toward the throat. A lip covers the lower teeth, but the upper are quite exposed. There are no teeth on the roof of the mouth. The pharyngeal teeth are very small and form small granular pavements. On one side there are four branchial rays; on the other side there are five. The gill-rakers are short and slender, setiform. Of the three bones behind the orbit the lower is the largest, about as large as the eye, and the middle one is the smallest.

The pectoral fins are but moderate in size, as long as the head; they reach a little more than half way to the ventrals, and they have fourteen rays. The dorsal fin is behind the middle of the body, behind the base of the ventrals, and has eleven rays, the second and third of which are prolonged into a point. The adipose fin is near the caudal, over the posterior extremity of the base of the anal. Anal elongate with twenty-six rays, of which the third to the fifth are elongate. Ventrals short, reaching the vent, in front of the dorsal, with eight rays. Caudal deeply notched, more than half of its length, with lobes nearly equal, the upper having thirteen rays and the lower but eleven.

Scales very large and thin, with membranaceous edges. The exposed portion of each scale is broad and short; it is silvered in its posterior half. In the lateral line there are forty-seven scales, in a series from it to the dorsal there are eight, and between it and the ventral there are four on one side of the body, or five on the other.

That portion of the air bladder lying immediately behind the skull is firmer and more rigid in its walls; its length is about one and three-fourths inches. The connection between the two parts is a narrow rather solid mass of tissue of about half an inch in length. The hinder section of the

air bladder is about five inches long by seven-eighths of an inch in greatest diameter, gradually tapering behind the middle; its walls are much thinner and not at all rigid.

The stomach is filled with parts of various plants, for the most part of some broad-leaved succulent cabbage-like aquatic plant. In cropping such thick leaves an upper lip would only be an obstacle. As the upper teeth are flush with the outline of the face and include both lower teeth and lip when the mouth is closed, the arrangement is admirably suited to the habits of the fish.

Total length sixteen and one-fourth, head two and three fourths, and depth four and seven-eighths inches.

Color nearly uniform, slightly brownish on the back, lighter beneath, silvery.

Hab.—Santa Clara, on the Rio Mucury, Brazil, where it was secured for the Museum of Comparative Zoology by Messrs. Hartt and Copeland of the Thayer Expedition.

The position of this genus in the system is close to the genera *Tetragonopterus* and *Scissor*. The species is named in honor of Dr. Henry Wheatland, President of the Institute, in token of appreciation of his friendly interest and sympathy in favor of ichthyology and ichthyologists.

Henochilus wheatlandi

ON BALISTES VETULA Linné.

BY S. GARMAN.

A HANDSOME specimen of this fish was taken at Wood's Holl, Mass., about the first of October and forwarded to Prof. Alex. Agassiz by Messrs. Geo. B. Appleton & Co. of Boston, the well-known dealers in fishing tackle. It is seldom this species of "trigger fish" is taken so far north, though it is common enough around Florida and the West Indies. The total length of the example in hand was nineteen inches, or fourteen excluding the caudal fin. The greatest height was nine and one-fifth inches, or without the dorsal fin seven and a half. In thickness at the middle of the body it was a little more than two and a half inches. It was evidently in very good condition, its great distance from its proper home notwithstanding. The formula for fins and scales stands thus:

D. 3 + 31; A. 29; V. 22; P. 16; C. $\frac{6}{8}$; L.l. 64.

The filamentary prolongations of the anterior rays of the second dorsal and of the upper and of the lower rays of the caudal are only moderately long, those of the caudal, however, being longer than the fin itself.

The colors on this fish are darker than on others from St. Thomas. The scales are not so dark as the skin between them. On the back and on the top of the head the brown is very dark, as, also, on the fins; it grows lighter on the flanks, to light below the chest and throat. The blue markings are vivid but not as numerous as on younger

specimens. They include the following: a narrow ring around the snout; a streak behind this, from its upper portion, along each side of the face, toward the ventral spine, stopping at the level of the lower edge of the pectoral; another stripe parallel with the last passing from the base of the pectoral over the forehead; a narrow streak from the lower edge of the eyeball across the forehead, and faint indications of one or more of the radiating orbital bands above this; a band along the bases of the fin rays of each of the fins; a wide band around the caudal pedicel, between which band and that at the bases of the caudal rays there is a single very narrow streak; and near each margin of each of the fins, but separated from it by a narrow edging of brown, there is a narrow band of the blue, that on the concave portion of the caudal fin being widest. Compared with Bloch's figure (of a smaller specimen) it lacks the narrow streaks on the central portions of the fins, has but two bands around the caudal pedicel, instead of four or more, and the lower band of the face does not extend back to unite with that touching the base of the pectoral, the latter band being continued farther down and also extended up behind the shoulder. Only two of the lines radiating from the eye are to be seen. The faint oblique lines seen on the back of the figure are entirely obsolete. The mentioned figure gives a very misleading idea of the teeth and of the ventral fins. There are in the specimen but eight somewhat compressed or incisor-like teeth obliquely extended forward in each jaw; the anterior pair are more pointed, and the others are notched so as to appear rather indistinctly bicuspid. The ventrals are peculiar; in that they appear as a single fin. On dissecting them out it is found that they really are separate fins which from opposite sides of the body are brought down and applied to each other on the median ventral line, so

that the outer extremities of the rays form a single series, those of one fin alternating with those of the other, while their bases are kept apart by the posterior prolongation of the coxa. The rays are all simple: the spine probably represents two rays, one from each fin. In the embryo no doubt at some stages the two ventrals will be found entirely distinct, and in tracing the affinities of the species backward we may expect them to lead to forms on which throughout their lives these fins remain separate.

SILURUS (PARASILURUS) ARISTOTELIS.

Glanis Aristotelis Ag., 1856, Pr. Amer. Acad., 333 (named).

BY S. GARMAN.

B. 13 (12–14); D. 3; A. 72 (67–76); C. 18; V. 9 (9–10); P. 1 + 11 (11–12).

In shape this species bears much resemblance to the *Silurus glanis* of Linné. Its body is elongate, depressed anteriorly, strongly compressed from the vent backward, the greatest depth in an eight-inch specimen being about one-fifth of the length without the caudal fin, and that portion of the length behind the vent being rather more than seven-elevenths of the total length. The head is broad, depressed, slightly arched across the crown, little less than one-fifth of the entire length, a trifle more than one and one-third times as long as wide, and is broad and rounded on the snout. Seen from above, the lower jaw appears to be the longer by the width of the band of teeth. There are but four slender threadlike barbels, of which the maxillary do not quite reach the end of the pectoral, not being one and one-half times as long as the head, while the mandibulary are less than half as long as the maxillary. The eye is so small that its diameter is contained more than four times in the interorbital space, more than twice in the length of the snout, more than eight times in the length of the head, and is nearly equal to the distance from the base of the barbel. It is situated above and close to the

angle of the mouth. A broad interspace, more than half the diameter of the eye, interrupts the narrow band of vomerine teeth in the middle; they might be described as two short transverse bands, the length of each of which is a little more than twice its width. In the first series the gill-rakers are short, sharp, rigid, not as long as the eye, and vary in number from twelve to fifteen. The dorsal fin is very slender, having only three rays, and is situated at about two-sevenths of the distance from the snout to the end of the tail, or a little in front of the hinder extremities of the pectoral spines if they are applied to the sides. There is no adipose fin. The anal fin is long, nearly four-sevenths of the length, without the caudal, and contains, in most cases, more than seventy rays. One of the individuals in hand has only sixty-seven. At the end the caudal fin is rounded or subtruncate; generally it has eighteen rays, rarely there are nineteen; it is united with the anal less than half its length. The ventrals are farther back than the dorsal; on four specimens there are nine rays in each ventral fin, on two others there are ten rays in each, and one has ten rays in one ventral and but nine in the other. In length the pectoral fins equal the distance from the eye to the end of the opercle; they are broadly rounded on the posterior margin, and most often contain one spine and eleven rays; rarely the number of rays is twelve. The spine is strongly compressed; the teeth on its hinder edge are sharp pointed and comparatively large, those in front are distinct but smaller.

The coloration of the back and of the top of the head is brownish, of the sides silvery with rather coarse brown puncticulations arranged in irregular nebulous groups which approximate to blotches along the base of the anal and on the anterior half of the caudal.

The description is taken from specimens in the Museum

of Comparative Zoology, collected by Dr. Roeser in the Acheloüs (Aspro) river in Acarnania, Greece. The largest is less than nine inches in length. From the young of *S. glanis* L., of equal length, they are readily distinguished by the possession of four barbels instead of six, by the difference in shape of those on the maxillaries — they being shorter, less compressed and more threadlike, by the wide separation in the middle of the band of vomerine teeth, by a larger eye, by a greater slope to the sides of the head, by a smaller dorsal, by the smaller number of rays in the anal, and by the markings.

Young individuals of *S. glanis*, from the Danube, have broader flatter heads, shorter lower jaws, smaller eyes, longer flatter maxillary barbels, smaller pectoral spines — without denticulations in front and with very small ones behind, blacker ventrals and pectorals, and flanks marbled with brown and white, the latter in irregular spots of varying depth but distinct definition. The eyes have less of a lateral outlook than in the Grecian species.

Apparently the new species is a near approach to that described as *S. chantrei*, by Sauvage, from the Koura (Kur) river, at Tiflis, a stream flowing into the Caspian. The characters given that species are "D. 3; A. 65; P. 1 + 13; V. 10." "Allié au *S. afghana*, Günther, en diffère par l'épine pectorale non dentelée, la bande vomèrienne subinterrompue au milieu, les barbillons plus longs." Günther's type had maxillary barbels twice as long as the head, vomerine teeth in a very narrow, uninterrupted curved band, a pectoral spine without denticulations, a dorsal with two rays and an anal with seventy.

The specimens above described are undoubtedly those of which Prof. L. Agassiz speaks in his communication to the American Academy of Arts and Sciences, Nov. 12, 1856, published in volume III of its Proceedings, p. 325.

On page 333, he gives the name *Glanis Aristotelis*, without a description. To complete the history of this fish we should have to include the references of Aelian, Athenaeus, Pliny and subsequent writers who have depended on the great Grecian author for their information. Though the species is allied to the *Silurus glanis* of Linné, it falls into a different division of the genus on account of the smaller number of barbels. It pertains to the group to which Bleeker gave the name *Parasilurus*, the members of which have but four barbels. The distribution of *Parasilurus* is thus shown to extend from the Adriatic across the entire southern part of Asia, and from the Caspian southward.

ON THE "GILA MONSTER" (*Heloderma suspectum*).

BY S. GARMAN.

LATE in May, 1889, through the kindness of Miss Mary Woodman, the Museum of Comparative Zoology at Cambridge, Mass., came into possession of an unusually handsome specimen of the "Gila monster," one of the largest of the lizards and the only one reputed venomous. He had been secured at Casa Grande, Arizona, by Mr. Daniel H. Bacon and forwarded in such a manner as to reach us little the worse for the handling and the change of climate. His arrival in good health and in the warm season gave opportunity for taking a number of notes that may add something to what is already known concerning the species. For more than a year he was kept alive and under observation. Animals that have been brought any distance usually arrive very thirsty, and the first move toward domesticating them is made in giving them water. Heloderma was no exception. In an arid dwelling place such as his, four or five days, the length of the journey, would not be expected to prove a very long time between drinks, but he drank as if nearly famished. A stupid and impassive appearance did not prevent such manifestation of intense enjoyment as made it a pleasure to watch the slow process of satisfying what, for the time, was the greatest desire of the creature's existence. More than half an hour elapsed from the time the snout was brought down to the liquid and the tongue thrust into it until the

head was raised and, licking the lips and yawning to disclose the inky blackness inside the mouth, preparations were begun on a sleeping place. Shortly afterward an egg was broken into a dish and placed within reach; it was taken with evident relish, in the same manner as the water; the chin was dipped into it and the tongue thrust out, bent downward and drawn back again. The tongue is thick and riband-shaped, *i. e.*, long, narrow and somewhat depressed. In protrusion it first makes its appearance as a single sharp point; as it comes farther out the tip separates into two points, and the organ is seen to be forked for a short distance. When fully protruded, the aspect is changed and the outline of the extremity, as seen from above, resembles that of the tail of a shad. As the tongue is drawn in, the tips approach each other till once more closely applied. Thus, the forked portion moves sidewise like the blades of a pair of scissors as the tongue goes out and back. Any of the fluid that adhered was carried into the mouth by the retraction, and no doubt the tongue was followed by a slight current induced by suction that took in a little more; the amount of suction, however, must have been very slight, judging from the time occupied in eating a single egg. On each of four days one egg was consumed; then followed a week of fasting, the most of which was cloudy weather. Readiness to feed depended greatly on the temperature and brightness of the day; in consequence the meals were quite irregular.

On the bottom of the box there were some inches of sand with several rocks; under the side of one of the latter the burrow was made. The digging was all done with the hands; beginning with the left the sand was thrown back with some force in slow strokes, about thirty to the minute, then the right was used in the same way. The motions were outward or lateral, not vertical like those of

a dog. For a while the sand was dug out directly, until it began to pour back; then a position was taken up on the top of the heap that had been made, and it was thrown still farther back; gradually working forward, conditions were soon made favorable for continuance of excavation at the bottom of the burrow. At the depth of about a foot the body was hidden and only the tail exposed. This depth appeared to be satisfactory for a time, and the dwelling was occupied as if complete.

The tail is club-shaped, near six inches in length by one and a half in diameter, and retains its thickness back toward the end where it rather abruptly tapers to become more slender and pointed. When the tail was sticking out of the excavation, as in digging, the slender extremity moved from side to side, back and forth and around, with more flexibility than was to be expected from its size, as if constantly on the alert for unseen danger. The organ is very sensitive. While asleep the tail was stowed as if to insure its safety; it was either extended directly back into the burrow, half of the body remaining outside, or, when the animal was wholly under cover, it was bent forward along the side. In sleep, the body lies flat on the sand and the arms were usually stretched back, palms upward. After a few weeks, less care was taken in regard to entering the burrow during the day, and the naps were taken anywhere in the box.

The box was not well placed for the sunshine; it was covered with a strong netting. Some attempts to get through the net one morning caused the occupant to be taken by the shoulders and lifted over into another cage where he might get the full benefit of the sun. This was quietly enjoyed until the sun had passed, then there was another attempt on the cover, followed by return to the first box and retreat into the hole. This came to be the

regular proceeding: every morning about nine o'clock the fellow climbed up in the corner of his box whence he was lifted over into the sunshine to take a nap until the shadows came upon him, then he would climb in the corner again till returned to the larger box to take his favorite position in his den for a while. To forget or neglect him was out of the question; his scratching would not permit it.

The number of eggs charged to him does not average more than one per week; the other food given him amounted to very little.

In the latter part of July he began to slough. The epiderm came off in a very ragged way, in shreds and patches. There seemed to be no effort to hasten the process and a month later it was not entirely finished. Thinking to hurry the matter, in case all had not gone along in the normal way, a bath tub was furnished with water sufficient to completely cover him. At once he showed a fondness for lying in the water with his snout sticking out; this was varied by lying on the bank with his tail sticking in, a position which he apparently found to be very delightful.

Heloderma was really good-natured. To be sure he was easily worried into self-defence, but there was nothing vicious in his disposition. To scratch him on the sides, or rub the knobbed scales of his back, or, more readily than either, to blow in his face would make him open his mouth, for which he was not much to be blamed, but even then something had to be put between his teeth to get him to bite, he had so little desire to take hold of his tormentor.

His thirst required more attention than his hunger; he drank frequently and always with great deliberation. To tempt his appetite various things, such as insects, worms, young birds, mice, meats and cooked foods were put be-

fore him. He took none of them voluntarily, but would swallow occasional offerings if they were put into his mouth. Some things he would not accept on any terms, they were put out of the mouth as fast as put in; others that he might be induced to swallow were held in his jaws for a long time. At the end of a year the only evidence of loss of flesh was to be noticed near the end of the tail, where it had grown a little more thin and pointed. The body had retained its plumpness, being rather more than three and a half inches wide to twelve inches long, without the tail.

His only sound was a long-drawn aspirate hah, like a sigh, produced by expelling the breath from the lungs. If teased till out of patience, this was given out with the mouth partly open, when it had all the force of a warning; whether it was intended for that purpose or was merely preparation for a struggle, by lessening the bulk, are still to be considered. It really answered both purposes.

In regard to the nature of the venom and fatality of the bite there is little to offer that is new. The results of the experiments suggest danger for small animals but little or none for larger ones. Large angle worms and insects seemed to die much more quickly when bitten than when cut to pieces with the scissors.

Acquaintance with this specimen has satisfied me, however, that the reports of the deadly nature of the species are mainly exaggerations, with little if any foundation in fact. Popular opinion and for that matter its manner of origin are illustrated by the following, credited to Col. A. G. Tassin, U. S. Army, in the Overland Monthly: "The "Gila monster is an ugly reptile peculiar to Arizona, and "as its name implies, most common along the Gila river. "It is a sort of a cross between a lizard and an alligator,

"roughly striped black and white on a yellowish back-
"ground. Its length varies from ten to thirty inches, and a
"large-sized fellow is as thick as a strong man's arm.
"When prodded with a stick it hisses and thrusts out its
"heavy forked tongue, raising its head menacingly, but
"scarcely moving otherwise. Its bite is often fatal, the
"effect depending more or less upon the state of the sau-
"rian's temper and the depth of the wound. Its breath in
"hissing is offensive, and issues from a wide-open mouth
"in puffs of black vapor or smoke. The Mexicans I have
"questioned all told me that it was exceedingly poisonous,
"as much so as the bite, if not more, while many of the
"Americans thought it harmless. Having myself seen a
"chicken and a small puppy killed by the hissing of one
"in their faces, I am inclined to think that it is best to
"keep from coming in contact with it." Comment on this is unnecessary. Still more conclusive in its way is the following, originally from the Cochise Record, reprinted without comment in the Proceedings of the Zoological Society of London, 1888: "Sunday evening Dr. Mathews
"was summoned, by telegram, to Fairbanks (a railway-
"station near Tombstone, Arizona Territory, U. S. A.),
"to attend Colonel Yearger, who was reported seriously ill.
"Owing to delay in the telegram, the doctor did not reach
"the patient until several hours after his death, which had
"been very sudden."

"It appears that Yearger had been fooling with a Gila
"monster and in attempting to open the creature's mouth,
"was bitten on the right thumb. Instantly the poison took
"effect, and although every convenient remedy was ap-
"plied, he lived but a few hours. An inquest was subse-
"quently held, and a verdict returned in accordance with
"the above facts."

"As this is the third or fourth death which has occurred

"in the Territory from bites of this reptile, it should set "at rest, at once and forever, the theory so prevalent that "their bite is not poisonous."

For comparison with the foregoing we may bring forward the evidence of a couple of witnesses of scientific reputation. They have no interest in destroying the character of the accused and may be expected to give testimony without prejudice. If they are less positive in their assertions than the preceding, it is possibly due to their actual acquaintance with the creature.

Dr. F. Sumichrast under date of 1880, in the Bulletin de la Société Zoologique de France, page 178, remarks concerning *Heloderma horridum:* "J'ai peu de chose à "ajouter aux observations de moeurs que j'ai publiées sur "cette espèce, il y a quelques années, si ce n'est, qu'après "de nouvelles expériences sur sa morsure, je suis arrivé à "la conviction qu'elle occasionne rarement la mort chez les "animaux d'une certaine taille et que, la plupart du temps, "elle n'est suivie que d'une enflure de la partie mordue qui "disparait au bout de vingt-quatre heures au plus ; c'est au "moins le seul effet qu'elle ait produit sur plusieurs jeunes "chiens que j'ai fait mordre dernièrement."

Dr. R. W. Shufeldt is one who, from having been incautious enough to get bitten, is entitled to speak with some degree of assurance. His statement is found in the American Naturalist for 1882, page 908. He was bitten on the right thumb, the teeth going to the bone, by a specimen at the Smithsonian Institution. The lacerated wound was in a few moments the starting point of severe shooting pains that passed up the arm and down the corresponding side. A profuse perspiration was induced. The pain made him so faint as to fall. The hand swelled rapidly, but the swelling went no farther than the wrist. The treatment included suction which drew not a little blood

from the wound, a small quantity of whiskey, external application of ice and laudanum and a lead-water wash afterward to reduce the swelling. He passed a sleepless night. By the next day the swelling was considerably reduced and thereafter disappeared gradually. The following is the conclusion of the doctor's statement: "Taking "everything into consideration, we must believe the bite "of *Heloderma suspectum* to be a harmless one beyond the "ordinary symptoms that usually follow the bite of any ir- "ritated animal. I have seen, as perhaps all surgeons "have, the most serious consequences follow the bite in- "flicted by an angry man, and several years ago the writer "had his hand confined in a sling for many weeks from "such a wound administered by the teeth of a common "cat, the even tenor of whose life had been suddenly in- "terrupted."

The most conclusive of my own experiments on the subject of this notice, *H. suspectum*, eighteen inches in length, was made with a young cat less than one-third grown. The cat was bitten on the right hand and wrist, the lizard holding fast like a bull dog, and blood was seen to flow when they were released. That there might be no doubt of the effectiveness of the bite, in two minutes the teeth were inserted a second time, the saurian retaining his hold and sinking his teeth deeper as the cat struggled to get free. For half an hour or more the wound occasioned some distress and was licked and dressed by the kitten, which then went to sleep for about an hour and a half. In expectation of its death it was left undisturbed. To my surprise it awoke as lively as if nothing had happened. Though the hand was somewhat swollen, it was but slightly lame. Twenty-four hours afterward when it was as bright as ever and apparently without ill effects from its mishap, the same cat was again bitten twice on the fore-

arm, a little higher than before. As in the first experiment there was no room to doubt the penetration of the teeth. The cat again licked the wounds and for a considerable time was occupied in dressing them. There was no disposition to go to sleep as on the day before. In two hours, as soon as the cat was inclined to pay no farther attention to its wounds, it was killed and the skin removed the better to note the effects of the bites. The fore-arm and hand were found to be swollen to twice the size of the opposite hand and arm. The track of each tooth was marked by the blood in and close around it, and the number and depth left no doubt of the conclusiveness of the experiment; the teeth had gone to the bones and between them. I saw nothing by which to distinguish the cuts from those made by a needle. There were no signs of disorganization in either the first or the second bites. Nothing could be seen in the way of discoloration or otherwise to give reason for any other conclusion than that the kitten would have entirely recovered in a few hours, by the time the swelling had gone down, if it had been allowed to live.

The outcome of such observations as have been made on this specimen has been confirmation of the opinion that the species is venomous to a certain degree, to an extent that, while it may most often prove fatal to very small animals, is only in exceptional instances deadly or perhaps even dangerous to larger ones. The effect on the kitten was identical with that on the puppies in Sumichrast's experiments. That poison was introduced by the bite was evident from the distress and swelling occasioned.

Dr. Fischer has described and figured secretory apparatus on the lower jaws; no glands have been found on the upper. There is an important question to be solved in connection with this apparent lack of venom-secreting organs on one of the jaws, which is quite as well prepared for its use as

the other on which the glands are so well developed. On both upper and lower jaws each tooth has a lateral groove on each side; these furrows are supposed to be for the purpose of inserting the venom in the wounds made by the teeth. Unless there are, not yet discovered, means of supplying venom to the upper teeth, it is difficult to see how their furrows are made available, if not by means of a quantity set free in the mouth, from the lower jaws, before the attempt to bite, a process of such uncertain efficacy as hardly to be considered probable.

Averse to torturing the creature, no attempt was made to verify the statement made by Sumichrast concerning the habit of turning on the back to defend itself when struck or beaten with a club. However, it might be expected to do just what is asserted of it under such circumstances, for the position would be that which would enable it most effectively to use feet and claws in aid of the teeth in self-defence.

The breath is no more colored than that of human beings; neither is it nor could it be any more offensive in its odor than the incense wafted from the lips of multitudes of the representatives of proud humanity. In regard to the breath being venom-laden, that of the specimen before us certainly was not so; here again it would be no very difficult undertaking to select an army of men with whom a comparison in this respect would undoubtedly prove complimentary to the "monster."

And, finally, it may be said that unprejudiced consideration of the matter as it stands between the reptile and his detractors will not fail to convince any one that a great deal of the disrepute with which so much of the testimony is weighted should not by any means be attached to the lizard.

THE DIFFERENCES BETWEEN THE GEOGRAPHIC TURTLES (*Malaeoclemmys geographicus and M. lesueuri*).

PLATE II.

BY H. GARMAN.

EARLY writers on our herpetology were not fortunate in their treatment of these turtles. Some did not recognize them as distinct, others considered them varieties of one species, while those who admitted their distinctness generally failed to make clear the differences between them. Most recent authors seem to have made use of characters furnished by early writers, and the result is that we have few descriptions which by themselves will enable us to say positively whether examples which come to our hands represent *M. lesueuri*, or its relative, *M. geographicus*.

The original description of *M. geographicus* (Le Sueur, Journ. Acad. Nat. Sci. Phil., 1, 86, 1818) gives no characters by means of which this species can be distinguished from the later-described *M. lesueuri*. But in the accompanying figure (*ibid.* pl. v), Le Sueur shows the characteristic large head, massive jaw and a peculiar tympanal stripe. After publishing this description, Le Sueur became acquainted with *M. lesueuri*, and the elder Le Conte, writing some time later, stated that he seemed to consider it the one he had described as *Testudo geographica*. However this may have been, his figure in the Journal of the Philadelphia Academy will not permit us to believe that Le Sueur had anything in mind but *M. geographicus* when

he made his first description and figure. Le Sueur seems not to have published a description, with name, of the second species. That he finally concluded they were distinct species is shown by his manuscript name cited in the synonymy of *M. geographicus* by Dumeril and Bibron.

J. E. Gray published the name *Emys lesueuri* for the small-headed species in 1831, but afterwards concluded (wrongly) that he had redescribed Le Sueur's species, and in 1844 (Cat. Tortoises, etc., Brit. Mus., 21) gives his own name as a synonym of *M. geographicus*, Le S.

Both turtles are common in the Wabash river at New Harmony, the home for some time of Thomas Say, yet this naturalist recognized but one species in his paper on the fresh-water and land tortoises of the United States.

Dr. Harlan (Journ. Acad. Nat. Sci. Phil., 1827) gives a brief description under the name *Emys geographica* which applies to either species.

The elder Le Conte recognized two forms, but after describing them (Ann. Lyc. Nat. Hist. N. Y., III, 1828–1836, 108–111), he remarks, "there are not sufficient differences between the two to constitute them separate species."

Dumeril and Bibron (Erp. Gen., II, 1835) unite the two forms as one species, yet on page 259, we read "la tete est plate, élargie; le museau, court, arrondi; les machoires sont très fortes, à surface convexe, à bords droits, extrêmement tranchans et sans la moindre dentelure," from which it would seem that the head of *M. geographicus* alone was described. On page 260, *M. leseueri* is indicated by a mention of forms in which the dorsal plates are tuberculate. Gray's name is placed among the synonymy.

Holbrook gave, perhaps, the best account of the two species that has been published in this country.

De Kay evidently did not know the species well. His

descriptions may be arranged, for convenience in comparison, as follows:

M. geographicus.	*M. lesueuri.*
Head very large, with yellow stripes but no spots.	Head moderate, with yellow stripes and large, confluent blotches.
2.	2.
Shell not elevated, smooth, ecarinate, serrated behind, with irregular meandering yellow lines.	Shell elevated, carinate.
3.	3.
Feet and tail striped with yellow.	
4.	4.
Length six inches.	Size of preceding.

The descriptions are misleading in several particulars. *M. geographicus* always shows spots on the head. They are small relatively in large examples, but are always present and are quite characteristic. In young and half-grown examples they are almost as conspicuous as in *M. lesueuri*. *M. lesueuri* does not show confluent blotches on the head. Spots are always present, but they are very constant as to position and form, are always well-defined and never, as far as I have observed, merge among themselves or with adjacent yellow lines.

The shell of *M. geographicus* is carinated, conspicuously so in youth, quite evidently so in individuals of medium size, and a carina is not wanting from examples of large size. The remainder of the statement concerning the shell of *M. geographicus* applies equally well to the related species. The same thing may be said of the description of the colors of feet and tail. There are no essential differences between the two in respect to the color of these parts.

Adults of *M. geographicus* will average eight inches in length at least and are often as much as ten inches long.

M. lesueuri averages smaller, yet examples are frequently seen that measure eight inches in length.

The only statement concerning differences, therefore, that can be accepted without important modification is that with reference to the size of the head. The head of *M. geographicus* is very large; the head of *M. lesueuri* is relatively small.

De Kay's figure of *M. lesueuri* is good in the main, but the markings about the head, if correctly drawn, were from an unusually marked example. I refer to the two large, comma-shaped yellow marks on the side of the head posterior to the eye. In the majority of examples, at least, there is but one of these marks, the more anterior, and it is above the tympanum, never before or behind it.

Dr. Smith (Rep. Geol. Surv. Ohio, iv, 661) describes the "head, neck and feet" as slender in both members of the genus. The truth is that no member of the family Emydidæ occurring in the United States has a head larger, relatively to the body, than the adult *M. geographicus*.

The statement consequently applies to *M. lesueuri* alone. On page 662 of the same paper the species are characterized thus:

Head and neck with yellow lines, often reticulated, and a single spot on each side or none; keel not very prominent.—*G. geographica*.

Head with very large yellow blotches or stripes; keel very prominent.—*G. lesueuri*.

From this we are left to infer that there is a difference between the turtles with respect to the markings of the head. Yet as far as they relate to such markings the statements might be transposed without loss in accuracy. The head and neck of both are lined with yellow in much the same pattern. In the great majority of both species also

there is a spot on each side of the head behind the eye and, very generally, at least, only one.

The statements with reference to the keel of the carapace are right for adults. Excepting reference made to the keels there is nothing in the description which follows that will enable anyone to distinguish the species.

The statement concerning a yellow spot before and another behind the ear in *M. lesueuri* was, I suspect, drawn from De Kay's figure.

The synopsis of reptilia by Messrs. Davis and Rice (Bull., III, Ill. State Lab. Nat. Hist., 1883) introduces the expression "spoon-shaped dilation of the extremity of the lower jaw" as a character separating the two inland species from the east coast turtle, *M. palustris*. The expression does not seem to me to fit either of the fresh water species closely, and I have never known a student using a synopsis or description in which the expression was employed to place either of the turtles in the genus Malacoclemmys. The mandible of adult *M. geographicus* is greatly expanded, not especially at the tip, but as a whole; and in this respect it is approached very much more closely by the east coast species than by *M. lesueuri*. In the last-named species the mandible is not noticeably expanded and certainly is no more spoon-shaped than the mandible of species of Pseudemys. If the expression was to have been used at all, it should have been for the purpose of separating *M. geographicus* and *M. palustris* on the one hand from *M. lesueuri* on the other. The two former are not so closely related as are the two inland species, but so far as this one character is concerned are certainly more alike. The statement that the dorsal plates of *M. lesueuri* are imbricated while those of *M. geographicus* are not, is not strictly true. The plates are not imbricated in the proper sense of the word in either species.

The sutures between dorsal plates are always exposed, and the imbrication referred to is a slight projection of the dorsal tubercle posteriorly seen in some young examples. In adults this tubercle does not commonly extend beyond the posterior outline, and the posterior extremity of the tubercle is in some examples as far in front of the posterior margin of its plate as it extends in others beyond it. In addition to which the tubercles are quite evident in *M. geographicus* and in young examples may show a tendency to project beyond the posterior edge of the plates. The statement that the markings of *M. lesueuri* are less distinct was probably made after an examination of young examples. Of the two the adult *M. lesueuri* is generally most brightly marked. Exceptions to this may occur, but I think not many. Adult *M. geographicus* are certainly very obscurely marked, though still maintaining much of the original pattern.

Similar objections may be urged against the account of the geographic turtles in Dr. D. S. Jordan's Manual of Vertebrates.

The jaw is described as having a spoon-shaped dilation, and the dorsal plates are said to be imbricated in *M. lesueuri*. The descriptions are good so far as they go, but no important difference between the species is mentioned. To illustrate, I will run briefly over the first one given, that of *M. geographicus*. It is described as "dark olive brown with greenish and yellow streaks and reticulations, especially distinct on neck, legs and edges of carapace." This will apply equally well to the other species with the exception of the reference to the greenish lines. On large examples the lines on the head and neck assume this color, and I am not aware that they ever do so in *M. lesueuri*.

The plastron is described as "yellowish." This will serve just as well for *M. lesueuri*, notwithstanding that

the description of the latter which follows would lead us to infer that the color was here different (it is said to be "yellowish, marbled with blackish"). In young of both turtles the latter description is applicable, for they are then marbled beneath. For adults the description of *M. geographicus* with reference to this point is right, for both species are when mature of a dingy yellow color beneath, the marbling having been gradually lost during growth. The remainder of the description, "carapace strongly notched behind and usually decidedly keeled," applies to both species.

COLOR.

The ground colors and the pattern of coloration are very similar in the two species compared stage for stage. They agree almost line for line and spot for spot. Thus, while a casual look at the dorsal sides of the heads of two young, one of each species, seems to show that *M. geographicus* has more yellow lines on this part of the head: close looking shows that with several conspicuous lines on the head of *M. lesueuri* are others more obscure, and that in reality the lines are nearly the same in number and position as in the related species.

The mark which will in most cases serve to distinguish *M. lesueuri* from *M. geographicus* is a yellow, comma-shaped spot behind each eye. Each spot begins near the posterior border of the eye, in line with the nostril, extends inward, sometimes a little forward, then turns posteriorly still nearing the middle line and growing narrower and, finally, passing into a yellow line which extends posteriorly on the neck. Sometimes one or both of the spots are detached from the neck line. In some cases instead of curving uniformly towards the middle line the spots may be a trifle expanded and angulated opposite the dor-

sal edge of the eye. In other examples the tapering portion of the mark is lost and there is left only the body, forming a large spot behind the eye. The isolated spot in such cases is quite characteristic from its transverse position and bright color. A median dorsal line extends from the tip of the snout posteriorly gradually widening a little till opposite the posterior part of the eye, then gradually narrowing and fading to be lost, commonly, near the point at which the two comma-shaped marks are nearest each other, but sometimes continuing back upon the neck as a very narrow and faint line. At the outer extremity of the comma-shaped spot are several narrow curved lines which start from the ventral posterior edge of the orbit and expand posteriorly and ventrally finally to turn inward posterior to the comma-shaped mark and run parallel with it. Other similar lines also starting from the orbit extend ventrally and posteriorly passing across the tympanum and continuing along the side of the neck. The latter are frequently broken and may encircle the tympanum, leaving a pale central dash. A yellow spot is almost invariably present beneath each eye. Three spots on the mandible are noticeable from their position, one on the symphysis and one at each angle of the mouth.

The expanded posterior extremity of the carina of each dorsal plate is in this species distinctly black. In young this is the only black of the dorsal side of the carapace. Later in life, large imperfectly-defined black blotches appear, one at the posterior edge of each costal plate; other blotches still more obscure occur at the posterior edge of each marginal plate above. Besides these, there may be a pair of black dots, one on each side of the ridge of each dorsal plate.

The plastron in young *M. lesueuri* is very characteristically marked. The whole central region, embracing most

of its area, is occupied by a dusky spot with short rays of this color reaching out along the sutures between adjacent plates. This dusky area is closely lined with obscure pale stripes.

The head of *M. geographicus* shows a mark behind each eye comparable to that I have described for *M. lesueuri*. It is never comma-shaped and is generally, perhaps always, completely isolated. It may be circular in outline, but is more often triangular, elongated and placed longitudinally on the head. It is very commonly enclosed by a very faint pale line from which another narrow line extends backward upon the neck. A median line occurs here also. It extends posteriorly from the snout, gradually widening to its posterior extremity, which is on a line with or a little anterior to the anterior edges of the spots behind the eyes. On each side of this line is a couple of faint lines which in some cases turn inwards behind the median line where corresponding lines unite. In other cases the inner lines unite thus, while the two outer join to form a single median stripe which continues posteriorly upon the neck. The characteristic line of the side of the head is a rather wide one which originates on the tympanum and thence extends ventrally and posteriorly upon the neck. Sometimes it gives off a spur towards the angle of the mouth and still another at the ventral edge of the mandible. A small pale dot is commonly visible beneath each eye. Spots corresponding to those described as on the mandible near the angle of the mouth in the other species can be made out here. But instead of the spot on the symphysis is a median line which extends to the posterior edge of the mandible where it expands and divides into two lines which diverge backwards on the ventral side of the neck. The expanded posterior ends of the ridges of the dorsal plates are brownish-black in young, but not

as distinctly so as in the other species. In the adult they are quite black and are larger. On each dorsal plate is a pair of black dots, sometimes more. At the sutures between adjacent costal plates are dark blotches, but they are smaller and less distinct than in the other species. Blotches at the sutures between marginals are also present.

The plastron of young *M. geographicus* is, as a whole, paler than that of *M. lesueuri*. The black of this region is not in this species so closely aggregated nor so extensive. In some examples it forms about a dozen isolated spots, each with concentric lines of pale yellow alternating with the black. In other examples the black occupies most of the plastron, but the yellow areas within it give the effect of a yellow plastron marbled with black. In adults of both species the plastron is dingy yellow in color, sometimes with a trace of the dusky spots, but in large examples without any trace of the pattern which is so conspicuous in the young.

Apart from the features which have been mentioned, the two species resemble one another closely in color. The general color of the shell, body, head and limbs, the reticulation of the carapace, and the pattern in limbs and body furnish no ready means of distinguishing the species.

FORM AND PROPORTION.

In examples of young and adults which were measured, the depth of the shell was about the same for the two species. An average of the depth of four examples of each species, the two sets corresponding very closely as to size of individuals, showed *M. geographicus* to be a trifle deeper.

But a more uniform convexity of the carapace of *M. lesueuri* conveys the impression of a deeper turtle. Owing to this roundness of the carapace the length along the

ridge is greater in examples of the latter than in those of *M. geographicus*, the size of the examples compared being the same. The following measurements of two examples will illustrate this:

	LENGTH OF CARAPACE.	WIDTH OF CARAPACE OPPOSITE THIRD DORSAL.	DEPTH OF SHELL AT MIDDLE OF THIRD DORSAL.	WIDTH OF HEAD.	WIDTH OF HEAD IN ARCH ALONG RIDGE OF CARAPACE.
M. geographicus.	2.44 in.	2.25 in.	1.12 in.	.50 in.	4.75 times.
M. lesueuri.	2.37 "	2.19 "	1.06 "	.50 "	5.17 "

The median dorsal ridge is a trifle less prominent in adult *M. geographicus;* in young of the two species not much difference is apparent in this respect. A peculiarity of the ridge of the second and third dorsal plates in *M. lesueuri* will generally enable one to recognize this species. When viewed from the side the outlines of the ridges of these plates are seen to be concave before the posterior tubercles, whereas in *M. geographicus* the outline is pretty uniformly convex from the base to the posterior extremity of each plate. Most of the bony neural plates in *M. geographicus* are wider than long; the reverse is true of *M. lesueuri*, most of them being in it longer than wide. With these exceptions the carapaces of the two species are much alike.

In young examples the heads are about equal in size, but an examination of the jaws shows the alveolar surfaces wider in *M. geographicus*. The adult *M. lesueuri* has a rather small head, not larger than that of a Chrysemys, while the adult *M. geographicus* has a large head, with jaws quite as massive as those of the snapping turtles. The width of the head of an adult of the former was found to be contained 6.4 times the length of the cara-

pace. The width of the head of an adult *M. geographicus* measured, was contained in the length of the carapace 4.68 times. The most surprising difference becomes apparent on examining the jaws. The alveolar surfaces are in *M. geographicus* greatly expanded and when the horny covering is removed the underlying bones are found to be peculiarly modified, the maxillary and palatine of each side with the vomer forming a wide plate with elevated inner margin which almost meets its fellow across the middle line.

The mandible is correspondingly expanded and flattened. Having relation to this enlargement of the jaws is a widening of the skull behind the orbits and a thickening of the supra-occipital process, both having to do with the increased size of muscles necessary to operate the jaws.

M. lesueuri shows nothing of this expansion of the jaws. The alveolar surfaces are little if any wider than those of *Pseudemys elegans*, the anterior portion of the vomer is fully exposed, and there is no elevated continuous inner margin formed of palatines, maxillaries and vomer. Compared as to the jaws and the bones entering into them, *M. lesueuri* is more closely allied to Pseudemys or Chrysemys than to *M. geographicus*. I can only account for the failure of the early writers to observe the important differences in these parts by supposing that they did not have adult examples of the two species for examination.

FOOD.

The examination of the contents of the digestive tube of *M. geographicus* throws light at once in the modification of the jaws and head.

In all those I examined the food consisted exclusively of mollusks, in the young turtles consisting of *Valvata tricarinata* and other thin-shelled species, in the adults of larger and thicker-shelled forms.

Previous to examining the alimentary contents I had observed a worn appearance of the alveolar surfaces and numerous shining particles in the crevices, the meaning of which was now explained.

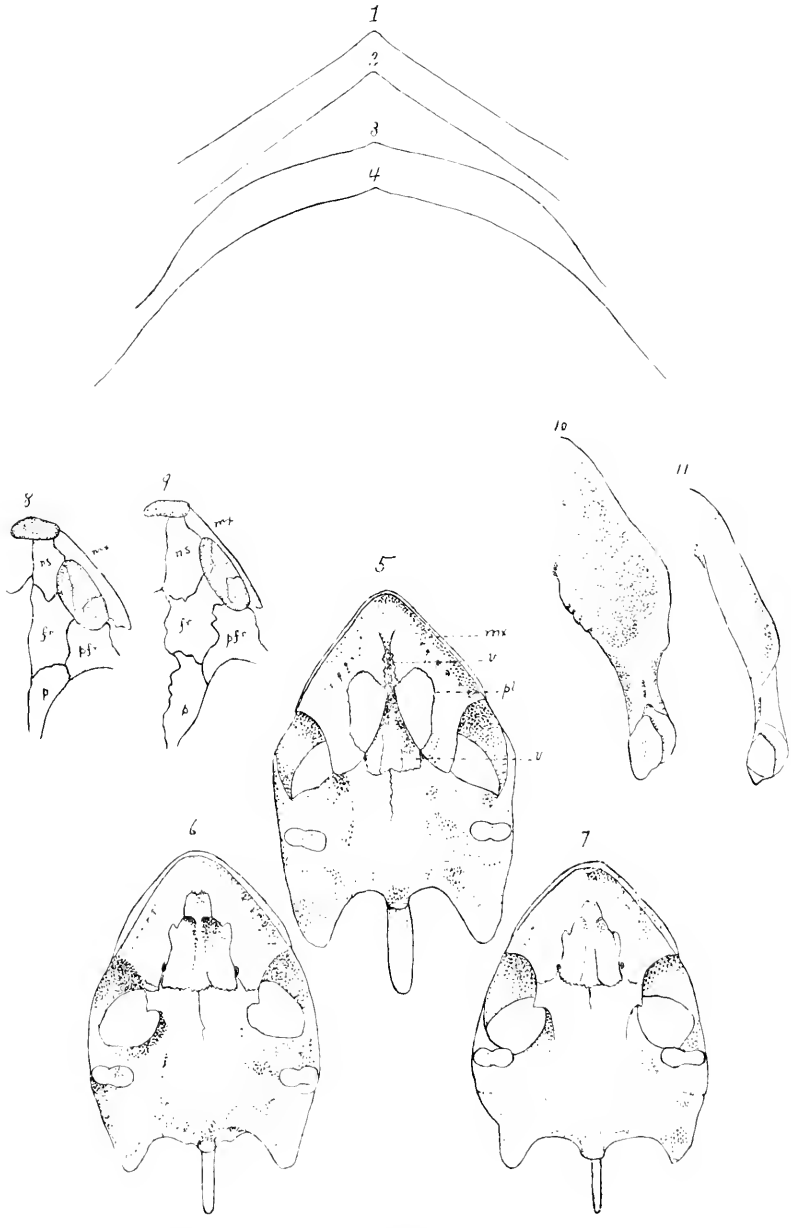
The digestive tubes of most of the adult *M. lesueuri* examined contained only the bulbs of a sedge which Prof. T. J. Burrill thinks is almost certainly *Cyperus phymatodes*. In some cases this species was found to have eaten cray-fish. Holbrook says it feeds on small fishes, reptiles, etc.

SUMMARY OF DIFFERENCES.

From the preceding matter the following characters may be brought together as serving for the separation of the two geographic turtles.

M. lesueuri.—Head small, width contained about 6.4 times in length of carapace. Alveolar surfaces of jaws not greatly expanded. Supra-occipital spine small, not thickened. Median ridges of carapace prominent; the dorsal outline of central dorsal plates concave before the tubercles. A comma-shaped yellow spot behind each eye, frequently continued posteriorly as a stripe on the neck. A yellow spot on the symphysis of the mandible. Averaging smaller than the following. Food mixed, animal and vegetable.

M. geographicus.—Head large, width contained about 4.6 times in length of carapace. Alveolar surfaces of jaws greatly expanded. Supra-occipital spine enlarged and thickened. Carapace with obscure median ridge; dorsal outline of central dorsal plates viewed from the side, a simple curve. Spot behind eye isolated, not comma-shaped, directed longitudinally. A stripe on symphysis of mandible. A stripe originating on tympanum. Larger than the preceding. Food, mollusks.



Malacoclemmys lesueuri, figs. 1, 3, 6, 8, 11.
M. geographicus, figs. 2, 4, 6, 8, 10.
Pseudemys elegans, fig. 7.

PLATE II.

EXPLANATION OF THE FIGURES.

FIG. 1.—Outline showing slope of carapace in young *M. lesueuri*.

FIG. 2.—Same of young *M. geographicus*.

FIG. 3.—Same of adult *M. lesueuri*.

FIG. 4.—Same of adult *M. geographicus*.

FIG. 5.—Ventral side of skull of *M. geographicus*; *mx*, maxilla; *v*, vomer; *pl*, palatine bone.

FIG. 6.—Ventral side of skull of *M. lesueuri* with same bones outlined.

FIG. 7.—Ventral side of skull of *Pseudemys elegans*, for comparison with Figs. 5 and 6.

FIG. 8.—Right side of skull of *M. lesueuri*, dorsal view; *mx*, maxilla; *ns*, naso-prefrontal; *fr*, frontal; *pfr*, post-frontal; *p*, parietal.

FIG. 9.—Same of *M. geographicus*, showing difference, especially between the frontal bones.

FIG. 10.—Right ramus of mandible of an adult *M. geographicus*.

Fig. 11.—Same of an adult *M. lesueuri*.

NOTE.—The observations of which the above is the result were made at odd times while connected with the Illinois State Laboratory of Natural History and are based chiefly on material collected by the writer in the Mississippi and Ohio rivers and their Illinois tributaries, but partly also on specimens collected or examined elsewhere in the United States.

A LOST PAPER ON HUGH PETER.

COMMUNICATED BY R. S. R.

The character of Hugh Peter, or Peters, has been the subject of a protracted controversy upon which it is not our purpose to enter. The partisans of Cromwell and of the Stuarts have in turn done what they could, on the one hand to elevate and on the other to blacken and defame it. The question is one to which Salem can never be indifferent, for the real character of the man, if it shall ever be finally established and vindicated, will be held amongst us as a precious heritage forever; or in the other improbable alternative, will endure as a conspicuous blot on our local history if the ugly imputations so freely bandied about amidst the courtly debaucheries of the Restoration are destined ever to be substantiated. The memory of Peters belongs in a sense to this town, for he not only ministered here with success between 1634 and 1642 but also interested himself extensively in ship building and in agricultural ventures, investing largely in real estate as well, acquiring at one time or another the land upon which the Pratt tavern stood and the Stearns Building was erected in 1792 and a number of other valuable tracts including, it is believed, the site of the Naumkeag Street Railway Office and the Joshua Ward house on Washington street, the house in which Washington slept in 1789.

His memory belongs too, in a certain sense, to the Essex Institute, for it is to that organization that the preservation of what remains of the church in which he preached has been committed.

Under these circumstances the possibility of securing for publication here an impartial and discriminating estimate of his character, not now in print, the mature work of one of the conspicuous writers of English History in the last generation, himself a Jew and an Israelite indeed who could regard the hot rage of Cavalier and Roundhead thus wholly removed from all bias and partisanship growing out of factions and antagonisms in the Christian Church, with the calm indifference of one whose creed allied him with the Mosaic era,—such a possibility when suggested possessed an interest not easily to be suppressed and prompted a series of efforts for the possession of the manuscript or a copy of it which have only just closed and which are here to be recorded. (See BULLETIN, XX, p. 56).

In Vol. II of the *Bibliotheca Cornubiensis* of the Messrs. George Clement Boase and William Prideaux Courtney, published at London in 1878, occurs, at page 474, amongst a list of works relating to the Reverend Hugh Peters, and filling nine of the large quarto pages of that exhaustive work, the following item:

"*A vindication of the Character of Hugh Peters, by "Isaac Disraeli, author of the Curiosities of Literature, "etc., MS.*"

"NOTE: This dissertation was to have appeared in con- "nection with the last edition of I. Disraeli's *The Life and "Reign of Charles I;* 1850: 2 vols. 8vo, but was acciden- "tally omitted. The MS. is still, 1875, *penes* his son, The "Rt. Hon. Benjamin Disraeli; *cf.* also, Curiosities of Lit- "erature (1858), i, p. xxxii."

In this prefatory chapter to the last edition of the Curiosities of Literature, dated 1848, but only issued in 1858, the Right Honorable Benjamin Disraeli, speaking of his father, says, "the last labor of his literary life was to vindicate the character of Hugh Peters."

My attention was called to these facts at Oxford, in an interview with which I was favored, in April, 1886, with the Rev. C. W. Boase, a fellow of Exeter College and a brother of the author. I afterwards availed myself of such means as lay in my power, from time to time, to trace out and, if possible, to secure for printing in our Historical Collections, so valuable a contribution to the local annals of Salem. But these efforts were without results until Mr. Lewis Fry, a member of Parliament for Bristol, visited the Essex Institute in October, 1888, and, interesting himself in the remains of the meeting-house in which Peters ministered, enlisted with ardor in the search. To him I am wholly indebted for such negative success,—apparently the only result possible,—as has at last been reached and I put on record these interesting communications in order to show that no effort has been spared, either on Mr. Fry's part or on mine, which could have led to the unearthing and publication of this unique production. Mr. Fry addressed himself directly to the Right Honorable Montague William Lowry-Corry, C. B., Lord Rowton, formerly private Secretary to the Earl of Beaconsfield and now his literary executor, with the following result.

GOLDNEY HOUSE, CLIFTON HILL, BRISTOL.

15*th* *Aug.*, 1889.

DEAR MR. RANTOUL:

You may remember that when we had the pleasure of seeing you last autumn you asked me whether I could ascertain from the late Lord Beaconsfield's literary executor whether Isaac D'Israeli's paper in vindication of Hugh Peters were in existence and whether I could get the original or a copy for your Historical Society. I did not at the

moment remember that the executor is Lord Rowton, formerly Mr. Montague Corry and Lord Beaconsfield's private secretary. After I got to town this spring I saw him on the subject in which he expressed a very ready interest and he promised that as soon as possible he would have a search made for the MS. among the very numerous papers in his hands. A day or two ago I received the enclosed letter from him. I am sorry my effort has not been more successful but you may be interested in having Lord Rowton's letter.

Yours very truly,

LEWIS FRY.

---

17 BERKELEY SQUARE, W.

August 12, 1889.

DEAR MR. FRY:

I am vexed that circumstances have, till now, made it impossible for me to execute the promise I made you in the spring, and that only to-day am I able to report to you the result of my search among the papers of Mr. Isaac Disraeli for the MS. in vindication of Hugh Peters.

As well as myself, my secretary, Mr. Seaves, has carefully looked them through, and I much regret to say that not a scrap relating to Hugh Peters can be found. Neither have we been more successful among the papers which have come to me from Lord Beaconsfield.

In fact, no such document, so far as I can learn, now exists.

It would have afforded me sincere pleasure; had my search been more fortunate, to offer the MS. to you for presentation to the Literary and Antiquarian Society of Salem. I am

Very faithfully yours,

ROWTON.

TO LEWIS FRY, Esq., M. P.

POSTMARK "STAVANGER."

September 5, 1889.

SIR:

Your letter of August 15th reaches me in a remote spot in Norway! It may be that, before this, you will have heard from our mutual friend, Mr. Lewis Fry, that I have, to my regret, failed after careful search (made with the object of gratifying your wish) to discover any trace or part of Mr. Isaac Disraeli's paper on Hugh Peters.

I am sorry to say that I am afraid that such a document no longer exists, since, so far as I know, all the remaining papers of Mr. Isaac Disraeli as well as of Lord Beaconsfield are in my hands. It would

have been to me a source of much pleasure to find myself able to satisfy the laudable desire of the Essex Institute to secure the publication of so interesting a bit of History.

I am, Sir,

Your faithful servant,

ROWTON.

To H. M. BROOKS, Esq.

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36 JAMES STREET, BUCKINGHAM GATE.

LONDON, S. W., 11 *Sept.*, 1889.

DEAR SIR:

Your letter of 28 Aug. to my brother the Rev. C. W. Boase of Exeter College, Oxford, has been handed to me as one of the authors of the Bibliotheca Cornubiensis. I perfectly remember the circumstances connected with the Hugh Peters episode to which you refer. In 1874 having become aware that Isaac Disraeli had written a vindication of Hugh Peters, although that vindication did not appear in his collected works, I wrote Benjamin Disraeli enquiring what had become of it. In course of time I had a reply from Mr. Disraeli's secretary, stating that it was quite true that his father had written such an article, which article was to have been given in the collected edition of his writings. By some unaccountable oversight it was however omitted, and now, 1874, although Mr. Disraeli had caused a search to be made for the MS. it could not be found, and he could not say what had become of it, but if it ever turned up he would let me know. I did not feel justified in pressing him further on the matter and I never heard anything more about it. I understand that all Lord Beaconsfield's papers were left unreservedly to Lord Rowton and if that gentleman has not come across the vindication in his researches I am much afraid that we must consider it to have been destroyed or at some time abstracted from its owner's possession. I agree with you entirely that it would be a most interesting document to print, and can but regret that it is not in my power to help you further in the matter.

I am

Yours very truly,

GEORGE C. BOASE.

ROBERT S. RANTOUL, Esq.

Salem.

BULLETIN

OF THE

ESSEX INSTITUTE.

VOL. 22. SALEM: JULY, AUG., SEPT., 1890. NOS. 7, 8, 9.

A STUDY OF SUMMER CEREMONIALS AT ZUÑI AND MOQUI PUEBLOS.

BY J. WALTER FEWKES.

THE present article is an abstract of a much larger work soon to be published in which I hope to treat in detail the several religious ceremonials which were observed by me at Zuñi Pueblo in the summers of the years 1889 and 1890. It is intended as a preliminary statement of observations on the externals of these ceremonials, leaving the interpretation of them to the more exhaustive account.[1] The substance of what is here given was brought out in a public lecture in Salem on the 24th of November, 1890, and a report of it appeared in the "Salem Gazette" of the following morning.

One word is necessary on the very threshold of our sub-

[1]The observations here recorded were made while connected with the Hemenway Southwestern Archæological Expedition.

ject in relation to the desirability or rather the necessity of placing on record all the data which can be gathered in relation to the religious customs of our Indians. The wholesale destruction of aboriginal religions by the early settlers has very much limited the amount of knowledge which we have of the characteristics of Indian ceremonies. In the case of our New England aborigines we have very meagre data bearing on this point. While fragments of their mythology can with great difficulty be gathered from the folk-tales of the survivors, and from the *ex parte* accounts which have come down to us from the writings of the colonists, who had no sympathy with "Devil worship," we have but little information of the nature and meaning of their religious ceremonials, or their forms of religious worship. With the growth of an intelligent interest in the study in a comparative way of the evolution of religion, it becomes desirable to have something more than can be gleaned from these sources. The best thing for us now to do is to endeavor to preserve what is left before that too is swept away into oblivion.

The inhabitants of a few of the pueblos of New Mexico and Arizona still preserve in a comparatively pure condition the religious observances and ceremonials of their ancestors.[1] The encroachments of the whites, and the inevitable changes which follow in the customs of the Indians, render it imperative that as many observations of these as possible be collected at once. Changes in ceremonials inevitably follow contact with the whites, so that it is highly probable that in no short time the religious observances at present practised will be modified or lost, and little

[1]That the Zuñians were formerly much more numerous is indicated by several facts. The large number of ruins of great size claimed by this race as belonging to their ancestors points that way, and the many folk-tales of persons dwelling in pueblos now in ruins look the same way.

remain to guide the future student in his researches on the indigenous or aboriginal religion of the southwest.

The primitive forms of religious observances which characterize these people and which have persisted up to the present are rapidly suffering great modifications, and unless efforts are made to record them permanently, in a generation or two they will be so much modified that the difficulty in distinguishing the ancient from the modern will be greatly increased. Without reflecting upon the excellent work which has already been accomplished in this direction it may be said that so much yet remains to be recorded that the field is almost a *terra incognita*. There is therefore a call for prompt action to secure the largest possible series of accurate observations of the religious ceremonials practised by these peoples before it is too late, and before the ceremonial habits of the race have been so changed that such records are impossible.

Of the several tribes of pueblo Indians, in New Mexico and Arizona, possibly the least modified in the particular which we are considering are the Moquis and the Zuñians. The former are the more primitive; the latter more easy of access. The present paper deals more especially with the latter, but references are not wanting to similar ceremonials observed among the former.

In the present state of our knowledge of the religion of the pueblos it is well to have some adequate even if didactic description of the ceremonies which are practised by them. It is therefore thought desirable to publish an account of those portions of the ceremonials which can be seen by all. A proper interpretation of those events is undoubtedly of still greater importance, but what is most needed at the present time is a trustworthy record of the observances as now practised. This article simply considers the events in a series of ceremonials as witnessed

by one who is not well enough acquainted with the meaning of the events to offer a satisfactory explanation of them.

The religious ceremonies which are here treated of are dances, and planting of prayer-plumes. There are also considered certain secular events which have a more or less religious nature in their performance. The Zuñians, as the inhabitants of other pueblos, are given to ceremonials, and every event in their lives has a religious side. As a consequence these observances are very numerous and varied and from the standpoint of a student it is difficult to separate purely secular celebrations from those of a sacred character.

Among the simpler ceremonials may be mentioned the planting of prayer-plumes, which are simple wooden sticks with feathers tied upon them. These sticks are either placed in the fields or deposited in special localities called shrines of which there are several in the neighborhood of the pueblo.[1] Two elaborate shrines are situated on top of a high tableland or mesa called Ta-yal-o-ne. These two shrines are dedicated to the Gods of War and the offerings upon them are quite elaborate. Their central object is a log of wood placed upright on which are cut rude human faces while other similar weatherworn logs are strewn about on the ground near the shrine. A cluster of prayer-plumes, some tied to the foot of the log, some upright in the soil in front of it, are offerings which have been

[1]One of the Zuñians told me that in old times there were two shrines in the pueblo near the old Spanish Church, now in ruins. A significant reminder of the Christian influence in Zuñi besides the old church is the cemetery in front of it where all the Zuñi dead are now buried without stone or inscription of any kind to mark their graves. In the middle of this walled enclosure stands a large wooden cross which was very dilapidated in 1889. At the beginning of last summer however this cross had been replaced by a new one and the adobe wall surrounding the grave yard had been renovated. As many skeletons are found buried in the floors of the old ruins even in Hal-o-na-wan on the opposite side of the river from Zuñi, it may be supposed that the present place of interment is a relic of Spanish influence.

placed there with ceremony. One of these, the offering of the Priesthood of the Bow, *Pith-la-she-wa-ney*, is a stick about six inches in length upon which is tied a miniature hoop with cotton network and small bow and arrows with small marine shells dangling from it. The enclosure in which these offerings were found was surrounded by an irregular wall of stones.

On the sides of the same mesa[1] there are several shrines in cave-like erosions in the rock. Some of these are simple rows of prayer plumes, great and small, while in others there are the skulls and bones of animals arranged with more or less regularity. Simpler shrines are numerous about Zuñi; some of them are small heaps of stones in the crevices of which are placed plumes; others have rows of prayer plumes deposited under an overhanging rock.

The shrine of *Her-pah-ti-nah* situated a few rods from Zuñi on the south side of the river near the site of the old town of Hal-o-na-wan is a rectangular rock enclosure with two chambers with entrances on the east side closed with flat slabs of stone. Within them there are offerings of sacred water, meal and feather plumes, while a few water-worn rocks are placed on the top of the shrine. This place is a sacred one to the Zuñians and was visited by them at the close of the *Ham-po-ney* dance, as later described.

Among the most conspicuous of the ceremonials of the pueblos are the sacred dances. The Zuñians preserve these observances in a comparatively primitive condition less modified probably by white influence than among those

[1] Ta-yal-o-ne, or Thunder Mountain, is a most conspicuous table-land to the south east of Zuñi. With it are connected many interesting Zuñi folk-tales and at its base are the ruins of former pueblos. The top was once inhabited as the ruins there attest and to it the whole Zuñi nation has more than once retreated for protection against their foes. This gigantic mesa is difficult to climb, the trail on the side toward Zuñi being often cut in the side of the precipitous cliff. There are also shrines on the "Twin Buttes," Quil-le-yal-o-ne, to the north of Zuñi.

pueblos which are christianized. The summer dances are exceptionally interesting and present most valuable examples of Zuñi religious practices.

Three kinds of dances were observed by me in the summer months. Of the first kind, called the *Kor-kōk-shi*, there were several. There was a single tablet dance, the *Hay-a-ma-she-que*, and several corn dances called the *Klahey-wey*. One of these latter, known as the *Ham-po-ney* or *O-to-nar-wey*, which is celebrated after long intervals of time, has rarely been witnessed by white men, and as far as I know has never been described.

The above mentioned sacred dances are only incidentally times of merriment, but are occasions of earnest ceremonials, and have a profoundly tenacious hold upon the people. They are eminently sacred in character and well illustrate the ceremonial observances of this kind.

DU-ME-CHIM-CHE.

This ceremonial precedes the first of the rain dances and is celebrated just before the first *Kor-kōk-shi*.

The ten priests, who will later be described as the *Koye-a-ma-shi*, form in line each with his hands on the hips of the one in front of him. The leader carries his hands on his knees. The line assumes a slightly stooping posture and chanting in a monotonous way the words *Du-me-chim-che*, *Du-me-chim-che*, *ā-ā-ā*, slowly trots along around the pueblo, under the projecting roof of the first story. The course of this strange procession lies through the numerous lanes, around the open plazas and the outer row of houses of the town.

The participants are naked, without the characteristic mud masks, their hair hanging down their backs. They wear a single coarse cloth about their waists.

As this strange procession makes its way about the town

the women who have stationed themselves on the edge of the roofs of the lower stories throw upon the heads of the participants jars full of water, first taking a handful of the same and throwing into the air as an offering. Little girls imitate their elders, and in one instance I observed a woman sprinkle a little sacred meal upon the clowns as they passed along. At the conclusion of the ceremony they retire to their house and the ceremony is not repeated. It happened on the same or nearly the same date in 1889 and 1890, but in the former year it was a day before the first *Kor-kōk-shi*, while in the latter it was four days before the same observance.

On the morning of the fourth day before the first rain-dance, there left the pueblo three men marching abreast who took the trail leading to Ojo Caliente. These priests chanted a song as they left the town. Of the three one bore in his hands a bundle of feathers and another carried a whizzer or flat slab[1] attached to a string which he whirled about his head making a buzzing noise as he marched along.

These men are priests who go to the Sacred Lake to perform certain observances preliminary to the first rain-dances.

On the third day after their departure at about nightfall a procession of dancers approached the pueblo from the southwest. Their song could be heard long before they appeared and near their meeting-place on the foothills a fire had been kindled, the smoke of which could be distinguished from the town. The men who formed this procession did not accompany the bearers of the feather offerings to the Sacred Lake, but were seen leaving the pueblo in threes and fours dressed in their ordinary costume, in the middle of the same afternoon. They carried

[1] Called *Klem-tu-nu-nun-ey*, the wind. This implement is also carried by the mythical personage, Pau ti-va.

their dance paraphernalia with them and dressed for the procession near the *rendezvous*.

The different persons who take part in the *Kor-kōk-shi* are (1) *Kō-kō* (2) *Lar-sho-wah-wey* (3) *Schu-la-wit-zer*, (4) ten *Koy-e-a-ma-shi* and (5) Bearers of the bundles of flags. The procession is headed by an unmasked priest who carries the sacred meal bowl and a feather wand.

KŌ-KŌ.

There are about forty men dressed to represent personages called by the Zuñians the *Kō-kō*. Over the head they wear a mask with a very long horse-hair beard. Upon this mask markings are painted and slits are cut in front of the eyes. Their own hair, carefully combed, hangs down their backs and in the crown of the head, feathers are fastened. A dependent string, weighted at the end, hangs down behind, on which also are tied feathers. Yellow and black feathers are placed in the hair.

They wear strings of shell necklaces and hanks of wool about their necks from which depends in a few instances the beautiful Haliotis shell, the well-known Californian "Abalone."

The upper part of their bodies and their arms are nude, somewhat daubed with a clay[1] or pink pigment on which, especially on the shoulders, zigzag markings were detected. These markings are said to be symbolic of water or rain. In one hand they carry a gourd rattle; in the other a sprig of cedar, a live turtle, or a flag leaf. The arm is ornamented with leathern wristlets[2] heavily set with coin silver

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[1] In certain Greek mysteries the initiated were daubed with clay. "This custom," writes Andrew Lang, "prevails in African mysteries, in Guiana, among Australians, Papuans and Andaman Islanders."

[2] *Chem-pas-sey-quin-ey*. It is an interesting fact that although the bow and arrow are very seldom used since the introduction of firearms the wristlet still survives as a popular ornament. Undoubtedly the former use of this was to prevent the string of the bow from striking the wrist in its rebound.

bands. Around the waist each *Kŏ-kŏ* has a ceremonial blanket reaching about half-way down to the knees and tied with a white belt with long, pendent, cord-like ends. In this belt are placed sprigs of juniper (cedar). From behind hangs down a fox skin.

The legs are bare with hanks of wool tied around them and anklets of cedar boughs. On the inner side of the knee-joint there hangs an empty turtle-shell with rattles made of hoofs suspended at the side by short buckskin thongs. The turtle shells serve as rattles by means of which by the motion of the leg an accompaniment to the dance is produced.

The song of the *Kŏ-kŏ* is melodious and begins with low notes rising to shouts and then sinking again to the original tones. In dancing there is no movement from one place to another, but a simple raising of the leg and bringing it down with force on the ground. The body is thrown slightly forward, the arms bent at right angles, the elbows of adjacent dancers touching each other.

LAR-SHO-WAH-WĖY.

There are several men dressed as women who accompany the *Kŏ-kŏ* in the dance. They face the *Kŏ-kŏ* and dance with them.

Each of these wears a white blanket with ornamental border extending down to the feet. Their hair is adorned with two great rolls made of yarn one above each ear after the fashion of the Moqui women. They wear also the great silver necklaces which are ordinarily worn by women. Their legs are painted yellow, and they have not the turtle-shell rattles worn by the *Kŏ-kŏ*.

SCHU-LA-WIT-ZER.

There accompanies the *Kŏ-kŏ* a little boy called the

Schu-la-wit-zer who carries a fire-brand[1] made of cedar bark ignited at one end. He wears a rounded helmet and a quiver with arrows, and his body is spotted with polka dots of different colors. He is a God of Fire and in one of the dances performs interesting ceremonials in connection with it. The fire of his wand is said to be kindled in a primitive fashion, and he is said to burn everything which comes in his path.

KŌ-KŌ-A-WEE-LEY.

The leader of the dancers is a priest clad in an old fashioned Zuñi costume with face elaborately painted. He carries a beautiful feather wand in one hand and a jar of sacred meal in the other. He sprinkles the sacred meal along the line of the dancers and faces so as to look down the line of *Kō-kōs* as the dance progresses. Hanging over his shoulders he wears a string of empty turtle shells.

The director of the dance who begins the dancing and the singing is clothed like the other *Kō-kō* and has a position midway in the line.

KOY-E-A-MA-SHI.

These personages are ten in number and while they sometimes follow the dancers do not take part in the dancing. From their making fun of the various events in the dance they may be called the "clowns" and the curious masks which they wear give them naturally the name of "mud-heads."

The mud-heads are naked with the exception of a coarse cloth about the loins. Their bodies are daubed with mud so that they are about the same color as the houses by which they are surrounded. Around their necks they

[1] The Zuñi name *op si-ne* has been given me as that of the fire-brand of the *Schu la-wit-zer*.

wear a coarse scarf and upon the heads a helmet or mask upon which are plastered great mud wens and eyes and mouth made of adobe. Their very appearance is ludicrous in the extreme.

They try in every way by action and words to amuse the lookers-on during the dance and at other times. On the day of its performance, at the close of the ceremonies, each of these personages is sprinkled with sacred meal by the leader of the dance beginning with the chief, the so-called father. Their peculiar satirical function calls to mind a primitive form of the theatre, a combination of amusement with the sacred ceremonials which is paralleled in prmitive stages of culture among Aryan races.

In addition to the various personages described in the preceding pages as taking part in the first *Kor-kōk-shi* dance there followed the procession as it marched from the foothills to the pueblo a number of men with great bundles of flag leaves on their backs. These flags play an important part in certain ceremonies inside the houses at this time, and are distributed among the Zuñians.

Let me mention the sequence of events in the first *Kor-kōk-shi*. On the night of June 24, a procession of dancers, composed of the personages which we have mentioned above, marched from the southwestern foothills to the pueblo in single file, chanting or singing a song of a wild and primitive nature. When the procession approached the river bank on the site of the old ruin of Hal-o-na-wan[1] it halted and after some delay crossed the dry river bed of the Rio Zuñi and mounted to the town through the alley between the Zuñi gardens. The *Kō-kō* then formed in line facing the west; the *Lar-sho-wah-wey*

[1] The ruin of old Zuñi lies on the southern side of the Rio Zuñi opposite the present town which is called Shewena. The Hemenway expedition house stands on the site of the pueblo of Hal-o-na-wan, "The Ant Hill," which is contiguous to the shrine of Her-pah-ti-nah.

stood opposite them and both began the monotonous song and accompanying dance. The flag leaves, borne by the procession, were collected together and carried into a neighboring house and a squaw sprinkled the dancers with pinches of sacred meal.

After they had danced at the west side of the pueblo they marched to the small open space which opens in the north side, then to the Sacred Plaza, then to that west of the old Spanish church now in ruins, and finally at about ten o'clock in the evening to the estufa adjoining the house of the Cacique of the Sun. Here they unmasked and danced apparently the same dance as in the plazas, but as I was unable to enter I know nothing of their ceremonials in that room.

On the following day the *Kō-kō* and *Lar-sho-wah-wey* danced all day in the open places, passing at intervals into the estufa. A grand feast was given them about noon time in that place, the food being brought to them by their squaws.

The *Koy-e-a-ma-shi* kept up a continuous exhibition of their foolery in the Sacred Plaza during the day, a spectacle which was watched throughout the afternoon by the men, women, and children of the pueblo congregated on the neighboring housetops and in available places in the plaza itself.

Several *Kor-kōk-shi* dances occurred in the course of the summer, all resembling in general the one already described, but in none of them was there a procession of *Kō-kō* to the pueblo on the night before the dance or a visit to the Sacred Lake for water.

HAY-A-MA-SHE-QUE.

As the season wore on there occurred a tablet-dance[1]

[1] So-called from the fact that the dancers wore painted tablets on their heads.

which differs quite essentially from the *Kŏr-kŏk-shi*. The dance seemed to be in commemoration of the arrival of the corn personified in a being called the *Meat-ta-tash-a* or the "Long Corn."

In the late afternoon of the day before this dance I observed a single "*Kŏ-kŏ*" approaching the pueblo along the northern bank of the river.

He wore a long, white blanket with ornamented border and carried in his hands two long yucca palm leaves. Upon his head there was a rounded helmet, upon the apex of which projected a rounded stick tipped with feathers. There were also other larger feathers on the top of his head. Around his neck projected a thick collar of cedar boughs extending outward like a ruff. A bell jingled on his leg and there were elaborate moccasins on his feet. The *Meat-ta-tash-a* ambled slowly up the rise to the west of the pueblo upon which the corrals are situated and with low hoots entered the town unattended. He is a stranger, it is said, who has come to town and is at first treated as such. He made his way through the Sacred Plaza, up the lane which leads to the estufa adjoining the home of the Cacique of the Sun. He mounted the ladder and trotting around the sky-hole sprinkled here and there a little sacred meal uttering the low hoots which were the only vocal sounds he has made since he came to town. A moment later he descended to the room below and immediately squaws approached the sky-hole bearing bowls of food and great bundles of *He-we* or wafer bread[1] as if to bring him a feast.

On the next day there was celebrated a dance in which the *Kŏ-kŏ* wear tablets and in which the *Meat-ta-tash-a* takes a prominent part. In this dance the *Lar-sho-wah-wey*, known as *Nar-weesh*, accompany the singers with

[1] Probably interesting ceremonials take place in the estufa but I have been unable to witness them.

a rasping noise made by rubbing two sticks together one of which is notched and placed on an inverted empty gourd. The *Kŏy-e-a-ma-shi* play their pranks as in the *Kor-kŏk-shi* and a great feast is held in the estufa at about noon.

Of all the personages who appear in this dance one of the most interesting is the *Ar-toish-ley* or the "Old Scold" who goes about the pueblo scolding every one whom she meets, declaring she will eat the children and kill the people. This woman wears a mask with face covered with spots. Her long gray hair falls down over her shoulders. She wears a black blanket with an old-fashioned wicker basket on her back. In her hand she carries a cane with a curved handle from which hangs from thongs a cluster of small hoofs which make a rattle as she emphasizes her scolding by bringing the cane down on the ground. Her legs are painted with round spots of variegated colors. Around her ankles are sprigs of green and her feet are bare. Many circumstances lead me to conclude that the *Ar-toish-ley* represents an old woman cactus picker, and theoretically I have supposed that she represents the olden times before the advent of the corn personified by the *Meat-ta-tash-a*. It is not impossible that we have here a dramatization of an historical event or an allegorical representation of the ripening of the corn in spite of adverse or evil influences personified in the Old Scold.

KLAR-HEY-WEY.

This is a woman's dance celebrated in a private house by eight women and one man, and as it is a dance in which corn is carried in the hand, may very appropriately be called a corn dance. I have seen the *Klar-hey-wey* on several occasions and every time it has on the whole the same general characters as follows:

On entering the room where the ceremony was per-

formed I found seated at one end eight Zuñi women elaborately dressed in holiday attire. In front of each was placed a basket filled with ears of corn heaped to overflowing. On either side were musicians and singers, the former seated about a basket covered with a white dance blanket from beneath which protruded the flaring ends of long horns, the latter about a native drum. The leading priests of the pueblo sat about smoking cigarettes which were lighted by a long fire-brand of cedar bark which was passed from one to another by Ni-u-che, the war-chief.

At a signal one of the dancers called the *Klar-ha-mosse* rose from her seat and quietly sprinkled a little sacred meal on the floor grasping in each hand an ear of corn and extending her arms at right angles began the dance. The singers who accompanied their song with a beating on the drum began their chorus and the dancer slowly edged her way to the middle of the room by means of a short sidelong movement, rising first on the ball of the foot and then on the toes slowly and silently keeping time to the song. She was followed by eight other women each with an ear of corn in either hand, with arms extended. There was also in the line midway in its length a solitary male dancer, scantily clothed, who also carried an ear of corn in either hand and who danced with a more rapid motion. Upon one of his knees a few bells were fastened which kept time to the music and song of the male singers.

The procession of dancers edged along sidewise to the middle of room, facing now in one direction now in another, slowly turning at a signal from the leader. Midway in their dance an old woman passed from one to another, taking the hands of the dancers in her own and drawing the corn which she held slowly across the mouth of the dancers two or three times.

After this ceremonial was repeated and the corn which she held brought to the mouth of each dancer, the dancing and singing going on at the same time, the line slowly withdrew to the corner of the room from which they had started, leaving a single performer behind who also likewise slowly edged her way back to her seat and as the music died out she gracefully waved the corn in the air, drew it across her mouth and deposited it in the baskets with those of her fellow dancers.

This was repeated shortly after, the dancers starting from an adjoining corner of the room, much the same as before except that the dance was accompanied with the horns as well as the drum with a new set of singers.

At nightfall the celebration of the *Klar-hey-wey* ceased and at its termination all present inhaled a deep breath as the singers left the room.

HAM-PO-NEY.

The most elaborate of all the dances by the women which was seen in my sojourn during the summer in Zuñi was a corn dance called the *O-to-nā-wey* or *Ham-po-ney*. This dance is in most respects not unlike the *Klar-hey-wey*, but is more elaborate and is participated in by all the Zuñians. It is celebrated very rarely and on that account a description of it has considerable value. When we reflect what changes come over the manners and customs of the pueblos in a few years we can readily see that those ceremonies which occur after long intervals of time are particularly desirable to describe. We do not know but that in another decade such a dance as the *Ham-po-ney* celebrated as it rarely is will be so modified that much of its primitive characters will be lost. It is, therefore, a profitable contribution to our knowledge of the ethnology of the Zuñians to record the present characteristics of the ceremony before the changes take place.

On the night before the *Hum-po-ney*, the *Koy-e-a-ma-shi* built in the sacred dance place a bower of cedar in which the dance of the morrow was to be celebrated. These priests cut the cedar from the hills at the south of the town and late in the afternoon came back to the place loaded down with great bundles of these boughs. With much raillery they decorated the beams of the bower which had already been built with cedar boughs, tying them on with grease-wood fibres. During this duty they were clad in the manner characteristic of this priesthood as already described.

On the morning of the dance, the bower was seen to be tastily decorated, and its whole interior occupied by seats for the dancers. There was an elaborate shrine in the middle of the building.

Two rows of blanketed seats extended down the middle of the house facing to the east. There were places for the women who later take part in the ceremonies. Between these seats there was made with sacred meal on the ground a terraced figure with apex pointing towards the east. On the eastern side of the house which was open, there was a line of four seats for as many women, the *Show-ko-mosse*, who take a prominent part in the dance. In front of them a line of baskets, heaped up with corn, was placed and a bank of feather plumes. A feather plume was placed in the ground near each seat.

The musicians sat on each side of the dancers. There were two sets of drummers and one squad who accompanied the dancers with the music of the horns.

The character of the dance was in general the same as that of the *Klar-hey-wey*. The dress, however, was much more elaborate and the paraphernalia more striking.

Eight women and one man danced in a row with a graceful movement of the body slowly edging their way from

the bower into the open plaza. They bore painted tablets on their heads and in their hands carried ears of corn and sticks upon which were tied feathers. Their arms were extended and swayed up and down as they went through the dance. The male dancer stood midway in the line and, when the women ceased, kept on dancing, raising one foot rapidly after the other. Brass bells rattled on his knees.

The ears of corn which each dancer held was drawn to the mouths of the dancers by several old women who performed that ceremony passing from one to another of the participants as described in the *Klar-hey-wey*. In the second part of the dance in which the musicians furnished the instrumental music, the dancers carried hand tablets similar to those which they bore on their heads.

The dancing was continued all day with the exception of a short time given to a feast when the dancers ate in the presence of the audience among whom the food was distributed after the dancers had eaten.

The dance lasted all night, during which a fire was kindled in front of the bower, and notwithstanding a heavy rain somewhat dampened the ground of the plaza, the dancing went on at intervals until daybreak.

In the morning a procession, composed of four boys and girls with Ni-u-che the representative of *A-hai-u-ta*, the war chief, and another visited the shrine of *Her-pah-ti-nah*,[1] marching three times around this sacred place. The slab which closes it on the east side was turned down, the chamber was opened and in it were deposited with prayers, offerings of feathers, water and meal.

[1] I am told by one of the Moquis that they have a shrine similar to *Her-pah-ti-nah* which they call *U-wor-ton-nah*. It is said to lie in the plain beyond Wol-pi.

An interesting shrine at Teg-na is the *Kar-ge* the "end of the trail," on the path up the side of the mesa from the spring. The "stone" in this is enclosed in a rock enclosure and is spirally coiled resembling a fossil.

LEY-LA-TUK.

Learning at the close of the *Ham-po-ney* that an interesting dance was to take place in the distant Moqui pueblo of Wol-pi, I left Zuñi on the following day and made a trip to this interesting pueblo. I was particularly anxious to see this dance, the *Ley-la-tuk*, because of its reported connection with the rattlesnake dance, since it is my intention to specially study this ceremony in some subsequent year. I, therefore, hurried away from Zuñi to Gallup and with a new "outfit" took the trail *via* Fort Defiance and Pueblo Colorado to the Moqui pueblos. I arrived under the shadow of the mesa upon which stands the first three Moqui towns, on the afternoon of Aug. 20, in time to witness parts at least of this most interesting and primitive ceremony.

The ceremony on the mesa began at sundown, but on my arrival at the pueblo in the late afternoon, the participants were assembled at a sacred spring in the plain below, where certain preliminaries were being performed. These I did not witness, but at a few minutes before dusk I observed a long procession winding up the side of the mesa to the town of Wol-pi, the most interesting of the three villages on the easternmost mesa of Moqui.[1]

About twenty persons took part in the ceremony at the well, and a few joined the procession after it reached the mesa top.

The line of participants marching from the spring to the mesa top was led by a priest who carried in his hand a

[1] It is a most desirable thing to study the character of the religious observances in the Moqui towns especially in Oraibe, the one which has least been influenced by the Americans and Spaniards. The Moquis have been studied with great profit by the Stevensons, Bourke, Stevens, Keam and others, but much yet remains before we can get at the true significance of their religious ceremonials. There is no subject in comparative religion which will better repay investigation than that of the ceremonial life of the Moquis.

basket of sacred meal. On his head he wore two horns, one on each side. A second carried a bowl of water and a feather wand. Two women and a boy followed.

The participants who followed the priests were scantily clad and many of them were painted. In their hair, on either side of the head, sunflowers were placed and around their loins there were sacred dance kilts or blankets. White streaks or bands were daubed on the body and along the sides of their legs. Each dancer carried in his hand a corn stalk with corn upon it. There were several naked boys in the procession who wore a profusion of shell beads, had horns tied to their heads, while their bodies were daubed with streaks of white. Behind the procession came two persons who carried bows in their hands and over their shoulders hung quivers filled with arrows. There was carried, likewise, a whizzer or a flattened slab tied to the end of a string, by revolving which they made a whizzing or buzzing noise. These men are said to correspond with the *Pith-la-she-wa-ney* or Priests of the Bow at Zuñi. They are known as the *Ka-lek-ta-ka*. The priests and boys with horns on their heads are called *A-lou-sa-ka*.

When the procession arrived at the open space which surrounds the pinnacle of rock where the snake dance is celebrated, it formed in lines with several abreast facing the rock and sung a low song without dance, the leader beating time with his foot. The song was accompanied with rattles and horns. The *Ka-lek-ta-ka* contributed to the song the noise of their whizzers which they whirled about the head. After the participants had sung their song at the edge of the open space around the rock pinnacle, they advanced a few paces and repeated the song and ceremony. This they did four times until they advanced to a lodge or bower, *She-hep-kĕ*, built of cotton-wood in the middle of the place. Upon the rock upon which they stood the

well-known crescentric figures, symbols of rain, *O-mou*, were marked out with sacred meal.[1]

The offerings of water, brought by the boys, were then handed to the *Uch-che*, a man inside the bower, and having delivered the offerings the procession left the place. The man inside the bower, and a woman, buried the offerings in a little crypt in the floor of the bower under a flat stone. When I visited the place shortly after the ceremony I found that the lodge of cotton-wood had been removed and the flat stone, covering the cavity in which the deposit had been made, was plastered up with adobe.

These simple ceremonies were all that I saw of the *Ley-la-tuk* in my short visit to Wol-pi. I was told that there was a connection between them and the so-called snake dance[2] performed at about the same time in alternate years.

While the speculative side of my subject is one which at the present state of my knowledge of pueblo life I have endeavored to avoid, there is one prominent idea which has forced itself on my attention in studying the summer ceremonials of the isolated pueblos which I visited.

The character of the religious ceremonials in summer is more or less modified by the environment under the influence of which these Indians live. I think there is much to show that the mythological and religious character of the Zuñians can be directly traced to the physical and climatic conditions by which they are surrounded. As they are agricultural people the great desideratum at this time of the year is water for their crops. As a result, rain dances, *Kor-kōk-shi*,[3] are most prominent features. These

[1] In a more detailed description to be published later, I shall give an account of how these rain figures were made by the priest, and the offerings which were thrown into them by the women and boys.

[2] It is desirable that, at the next celebration of this weird ceremonial, systematic efforts be made to bring to light the true meaning of the ceremony.

[3] Literally, good dances.

dances are said to be primarily for rain which is much needed in this arid region at this time. The same need of water has, no doubt, led to the visit to the Sacred Lake and the ceremonies connected with that event. Hence, also, the religious observances at the spring at the time of the *Ley-la-tuk* and the almost universal planting of prayer offerings in the fields.

In a study of the *Ley-la-tuk* at Moqui we have an interesting contribution to this line of thought. It will probably be found when the idea back of that strange ceremony, the snake dance, is thoroughly understood that it is connected intimately with the climate of the surrounding country.

The *Kol-o-wis-si*, or plumed serpent, one of the most powerful agents evolved in the mythological conceptions of the Zuñians, is a water being. All the waters of the earth are said by the Moquis to come from the udders of *Bo-ho-li-kon-ga*, a fabulous crested serpent, father of all life, as *Muing-wa*, the earth, is its mother. To kill a snake is to destroy the sources of water, and snake worship is connected with water worship if such an expression may be allowed.

The importance which attaches to the Moqui ceremony called *Ley-la-tuk* comes from the suspicion that it is the same as the snake dance, and embodies all essential elements of the latter. There are good reasons to believe that these two ceremonies differing as they do in details are really the same, but that the *Ley-la-tuk* is the most primitive. The snake dance may then be regarded as an elaboration of the ceremony of *Ley-la-tuk* to which are added many secondary symbolic observances. The gathering, handling, and sprinkling of the snakes with sacred water and meal from obvious reasons have fixed the attention and become prominent or rather the most important things in the ceremony. The snake has thus come to give the name

to the dance, but it is by no means sure that the ophidian part of the ceremony is the most important; it is rather secondary, and in the simpler observance of *Ley-la-tuk* we have the primitive meaning of the observance which in the snake dance is masked or possibly lost. The snake is the guardian of the springs of the water, and as such is very properly carried in ceremonials for water, just as in the Zuñi *Kor-kŏk-shi*, the live turtles, are carried in the hands of the dancers. One can readily see how the introduction of the live snake, effective as it is as a symbol, would in the elaboration of the observance lead to an undue development of a subordinate feature of the dance. Instead of a rain ceremonial it became a snake dance and as such is at present known to the majority of the Indians. The ceremonials connected with one of the symbols so overtowers the others that it conceals from sight the true nature of the observance. That is precisely, it seems to me, what has happened in the snake dance. I would regard it not so much an instance of snake worship, but as a rain or water ceremony in which the snake as a symbol of the sources of water, the springs, is introduced. The impression made by its introduction naturally led to the elaboration of all events connected with its capture, handling and introduction in the dance into ceremonials an account of which is given in such an entertaining manner by Captain Bourke. The idea behind this Moqui snake dance, once universal among the pueblos, now obscured by the display of living snakes carried in the mouth, is a ceremony for water in the springs of which the serpent is guardian.

The ceremony of *Ley-la-tuk* has all the essential parts of the snake dance except the ceremony with the snakes. It occurs at about the same time in the year on alternate years. From the nature of all the ceremonies in *Ley-la-tuk;* the exercises at the Sacred Spring in the plain, the

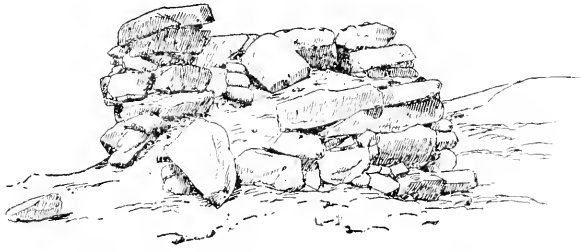
rain symbol on the earth, the Sacred Lodge, and the deposit of offerings of water in the receptacle below, there seems no doubt but that this dance is a rain ceremonial which has many other ceremonial ways of expression.

It is a noteworthy fact in this connection that the highest stages of culture on the American continent among aborigines is found where the climate is so dry and where nature has done so little for the agriculturist. The fertile well-watered valley of the Missouri and Ohio would seem much more favorable to the development of the agriculturist than the deserts of New Mexico and Arizona. There are more fertile regions in South America than those in which the Peruvian culture flourished. Possibly, the abundance of game in such regions rendered it less obligatory for man to become an agriculturist. He remained a nomad because game was plentiful, and as long as this source of food remained agriculture made slow growth. The arid deserts however, although less suited for cultivation than the bottomlands of the river banks, furnished only scanty hunting privileges. The buffalo could not be relied upon for food and man was forced to cultivate the soil. The moment primitive man became an agriculturist he became sedentary, and he began to live in settled abodes. Then would naturally arise a system of observances instituted to bring rain for crops and elaborate ceremonials be practised which would not arise among a race of hunters. Dry climates, for some unknown reason, have always had an influence in leading a man from a nomadic to a sedentary condition or from the hunter to the agriculturist, and many of the civilizations on the old continent have arisen in similar desiccated regions.

The writer believes that certain similarities in the religious observances of the pueblos to those of other primitive peoples inhabiting a desiccated country are di-

rectly traceable to the conditions of the region in which they live. To an agricultural people whose greatest necessity in summer is water for the success of the crops, it is perfectly natural that the similar systems of religious observances should arise. The human mind in early stages of its development in primitive society is the same, and would necessarily be affected in the same manner and would resort to similar observances. The powerful influence of observances practised in that stage in man's development, when he passed from the hunter to the agririculturist, would tinge all his subsequent religious growth.

If we analyze the climatic conditions which have exerted an important effect upon early beliefs an arid climate or one which sparingly supplies water may not be the least. The study of the religious observances in summer among a people who have not progressed out of the younger stages of growth, but who still live in such an arid region under conditions not unlike those in which sedentary habits first arose is therefore of more than a passing interest.



MOQUI SHRINE, *Karge*, "THE END OF THE TRAIL."

BULLETIN

OF THE

ESSEX INSTITUTE.

VOL. 22. SALEM: OCT., NOV., DEC., 1890. NOS. 10–12.

MONDAY, MAY 19, 1890.

THE annual meeting was held this evening at 7.30 o'clock; the President in the chair. The records of the last annual meeting were read and approved.

The *Secretary* read his annual report which was accepted and placed on file.

The *Treasurer* read his report on the financial condition of the Society; having been duly audited, it was accepted and placed on file.

On motion of Rev. E. B. Willson it was

Voted, That the thanks of the Essex Institute be tendered to Mr. George D. Phippen, the treasurer (who has declined being a candidate for re-election), for his faithful services during eleven years in this office. After remarks complimentary were offered by Rev. E. B. Willson, Dr. N. R. Morse, Mr. John Robinson and others, the vote was unanimously adopted.

The report of the librarian, Mr. C. S. Osgood, was read, accepted, and placed on file.

The report of the auditor, Mr. R. C. Manning, was read, accepted, and placed on file.

The report of the committee on nominations, T. F. Hunt, chairman, was read by the secretary and accepted.

Voted, That the meeting proceed to the choice of officers for the ensuing year. Messrs. G. M. Jones, Wm. L. Welch and Arthur R. Stone were appointed a committee to receive, sort and count the votes.

The committee reported that the following were elected unanimously :

PRESIDENT:

HENRY WHEATLAND.

VICE-PRESIDENTS:

ABNER C. GOODELL, JR., DANIEL B. HAGAR,
FREDERICK W. PUTNAM, ROBERT S. RANTOUL.

SECRETARY: HENRY M. BROOKS.

TREASURER: GEORGE D. PHIPPEN.

AUDITOR: RICHARD C. MANNING.

LIBRARIAN: CHARLES S. OSGOOD.

COUNCIL:

WILLIAM H. GOVE, S. ENDICOTT PEABODY,
THOMAS F. HUNT, DAVID PINGREE,
DAVID M. LITTLE, EDMUND B. WILLSON,
WILLIAM MACK, GEORGE M. WHIPPLE,
EDWARD S. MORSE, ALDEN P. WHITE.

Voted, That the committee on nominations be instructed to report at an adjournment of this meeting, to be called by the secretary, the name of a candidate for the treasurership.

THE RETROSPECT OF THE YEAR,

compiled from the reports read at the meeting and the remarks of the members in relation thereto, presents the work of the Institute in its various departments, since the last annual meeting.

FIELD MEETINGS. Two have been held with unabated interest during the past season; arrangements were made for holding others which were postponed on account of the unfavorable condition of the weather on the days appointed.

FIRST MEETING was held at Danvers, Thursday, June 20, 1889. A party of about fifty persons went in barges from the rooms of the Institute at 9.30 A. M. and visited the objects of interest, according to a programme furnished by Mr. Alden P. White and other friends.

First, the old Jacobs House situated on the banks of Waters River, the home of George Jacobs executed as a wizard in 1692. His grave is near by. The house is now occupied by the family of William A. Jacobs, a lineal descendant. It is a well-preserved old house; its low ceiling and the general appearance of the interior bear the mark of antiquity. Thence proceeded to Gov. Endicott's "orchard farm" upon which are the Iron works, the Porter mansion built by the Hon. Nathan Read; the old Endicott pear tree; the site of the Governor's house and the burying-ground; thence by the Collins' House which was the headquarters of Gen. Gage in the early days of the Revolution, now the residence of Francis Peabody, Esq.; the grounds of the Peabody Institute; the House of Rebecca Nurse executed for witchcraft; the Nurse monument; the homestead of Judge Samuel Holten in the vicinity of the church of Salem village; the present church; the site of the First Meeting House where Rev. Samuel Parris preached and the site of the parsonage where the witchcraft delusion first broke out; the common at the centre bequeathed by Nathaniel Ingersoll as a "Training Field" forever; the beautiful grounds of the farm of George Peabody of Salem; Hathorne Hill and the Danvers Insane Asylum.

The barges then proceeded to the house of Dudley A. Massey, a most delightful place, where the company were entertained by the proprietor and members of the Danvers Improvement Society and upon his lawn the lunch was partaken of and the afternoon session was held.

About 2.30 P. M. the meeting was called to order by the President who stated that it was forty years, this month, since the first field meeting of this society was held; of those who attended, about fourteen in number, only three or four survive; they came in private carriages and visited portions of Wenham and Danvers, the meeting was held in one of the parlors of Berry's Tavern in Danvers Plains and was entirely of a botanical character. Dr. Andrew Nichols, Rev. John Lewis Russell, Messrs. G. D. Phippen, S. P. Fowler and others were among the speakers. Three other meetings were held that season: one at the house of A. T. Newhall in Lynnfield, one at Knowlton's near the ponds in Hamilton, and the third at Smith's point, in Manchester.

Mr. Geo. D. Phippen, being called upon, gave a further account of the first meeting in 1849, with personal reminiscences of those who took part.

Rev. C. B. Rice, of the First church in Danvers, was then introduced. He spoke at some length on the subject of witchcraft. He exhibited the old church records kept by Rev. Samuel Parris, also a piece of a board from the Parris House.

William P. Upham, Esq., followed Mr. Rice on the same subject. Mr. Upham thought the lack of a good education was the main cause of the witchcraft delusion. That the first settlers in this region were men of culture for the most part, but after one or two generations had passed, there was a decline in knowledge and common sense. This, he said, had been confirmed in various ways:

Improvement Society for the exceedingly bountiful collation furnished by them to the Institute and its friends and the thanks of the Institute be also tendered to Alden P. White, Ezra D. Hines and Andrew Nichols, Esqs., for their attention and kindness in pointing out places of interest on the route from Salem to this place; also to those persons who opened their residences to the inspection of the members of the Institute; also to the proprietors of the First Church for the privilege of visiting their church and to all others who have contributed to the interest of the occasion.

The meeting then adjourned. At 4.30 P.M., it was announced that the barges were in readiness for the homeward trip; on the way to Salem, the party visited the birthplace of Gen. Israel Putnam of the Revolution, where, in the room in which the general was born, is an old chair which had belonged to him. This house was built in 1648 and was therefore rather an old house when the general was born. The party passed the house of Sarah Osborne, one of the first accused of witchcraft; they also made a call at Oak Knoll. Besides the number who went in barges, several went by horse cars and private carriages.

THE SECOND FIELD MEETING was held at Ipswich Bluffs on Thursday, Aug. 22, 1889. The weather was remarkably pleasant, one of the finest days of the season. The party of some seventy persons left Salem at 10 A.M. for Ipswich where, upon arrival, barges were taken to the steamer "Carlotta" which, after a pleasant sail, landed the party at the Bluffs. An hour or two was passed in rambling about the place looking after any objects of interest that might turn up and enjoying the fine air and scenery. At one o'clock a large portion of the company who had taken baskets spread their lunch in an old-fashioned barn and

partook of refreshments in a primitive way. A few dined at the hotel. At 2.30 P.M. the meeting was called to order, the president in the chair. In the absence of the secretary, who was detained at the rooms in Salem, Capt. George M. Whipple was chosen secretary *pro tem.*

Prof. E. S. Morse was the first speaker; he discoursed upon the shell heaps found in this vicinity. He thought they were of great age; one proof of their antiquity mentioned was that the bones of the great auk, a bird now supposed to be extinct, are found in great abundance in these heaps. These birds were once numerous, but only a few specimens are now preserved in any museum. A molar tooth of a polar bear has been found in heaps near Portland or Portsmouth showing that the heaps were made when the climate was cold enough for that animal many centuries ago. Professor Morse also spoke upon the gradual change in the shape of the clam, attributed to a change in the climate of these regions.

Abner C. Goodell, jr., was the next speaker. He spoke of the value of old records; regretted that the earliest people did not make any record of their lives and habits. He compared the present modes of recording and presenting the facts of history to the limited opportunities of the olden times. The art of photography, had it been in use in the early days of New England, would have preserved to us views of great interest and value. John Smith in 1614 mentions "Plumb" Island and said it was covered with mulberries probably mistaking those trees for plum trees. Baker's Island, Mr. Goodell said, was named for Isaac Baker, who was killed on that island while felling a tree. He said the imperfect account of the early years of America should teach us of the present time, faithfully and fully to put on record the events great and small of to-day.

John H. Sears spoke in reference to the peculiar geo-

logical formation of the locality and of Essex County in general, the rocks along Parker river showing the oldest geological formations of the county, while the sands and marshes of Plum Island show the latest; Mr. Sears also spoke of the glacial period as connected with this locality.

George D. Phippen was next called upon and he gave some interesting information about the formation and development of the common fruits.

J. J. H. Gregory of Marblehead said he was an "old timer" at the Field Meetings and was astonished at the new ideas advanced by the younger men now in the field, and said that he was inclined to go back to his books for new instalments of knowledge. He believed that he was one of the first to examine the shell heaps of this vicinity. He complimented Mr. Sears for the work he had done in Essex County, and hoped he would publish his results. He also believed that the Norsemen were the discoverers of this continent centuries before the English came here, and gave some reasons for his belief.

Mr. L. L. Dame of Medford, a member of the Middlesex Institute, was requested to say a few words. He said "Middlesex takes off its hat to Essex." Essex he considered the pioneer in historical matters.

His remarks were upon the trees on the island in early times. Most of the islands were thickly wooded, and he deplored the extensive cutting away of the trees not only on the islands but in different parts of the country. He approved of the establishment of public parks and spoke particularly of Middlesex Fells. Hoped that the islands of our bay could be planted with trees.

Mr. Gregory asked Mr. Sears to state what trees grew on House Island off Manchester shore, the only island in this vicinity which is covered with a healthy growth of wood.

Mr. Sears said the island was covered with bass, cedar, red oak, ash and white oak. On Eastern Point the trees are vigorous and hardy, some are large and lofty, red maple, oak, ash and hickory. He thought the growth could be recovered by liberally re-seeding, and instanced successful experiments which had been made at Rockport where he himself had planted a peck of acorns.

The meeting adjourned in season to take the steamer for Ipswich, at which place the party took the cars for Salem, at 5.59 P.M.

REGULAR MEETINGS were held on the first and third Monday evenings of each month. At some of these and also occasionally on intermediate Monday evenings, the following lectures were delivered.

Monday, Nov. 18, 1889.—Mr. William Cranston Lawton, of Cambridge, secretary of the Delphi committee of the Archæological Institute of America, lectured on the "Proposed excavations of Delphi in ancient Greece." The Gazette says, the lecturer "spoke enthusiastically of the importance of studying the ruins of the past, where, in art, three great qualities were always foremost: simplicity, truth and beauty. The American school in Athens, now seven years old and wholly supported by subscriptions, was described and the importance of its work in literature and art fully shown, the enthusiasm of the students being such that many have voluntarily and at their own expense carried on the excavations of ancient Delphi, long the religious centre of the Greek world famous for its oracle and temple, and a power political and intellectual; there remains simply the outlines of its terraces, while a straggling village occupies the site of the temple. A long section of the foundation wall has already been uncovered revealing more than seven hundred inscriptions cut in the

rock, a mode of recording events and which are now of great interest. It is the design of the society to raise the necessary funds and then, with the permission of the Greek government, buy and remove the village when it is believed excavations will reveal to the world treasures of inestimable value."

Monday, Dec. 2, 1889.— Hon. Eben F. Stone read an interesting paper on Gov. John A. Andrew, "the Massachusetts war governor."[1] Mr. Stone knew Gov. Andrew intimately and had a high opinion of his character and talents. The paper was well written and was full of reminiscences and personal recollections of one of the most popular men of his day; and perhaps one of the best governors we ever had in Massachusetts. He appeared to be like President Lincoln "a providential man" and moved the masses of the people by his eloquence and power.

Monday, Dec. 16, 1889.—Rev. G. T. Flanders, of New Bedford, read an instructive and interesting paper on Mohammed and Mohammedans, giving some account of the state of religion and especially of christianity at the beginning of the career of Mohammed in A. D. 610, and then reviewing his life and character very fully. He did not regard the prophet as either an impostor or a lunatic, but a providential man, a man for the times, true to his mission, so to speak. He also gave some account of the Koran and its doctrines, showing a thorough acquaintance with his subject.

Monday, Jan. 20, 1890.— Rev. A. P. Putnam, D.D., of Concord, delivered an interesting biographical sketch of Gen. Moses Porter "an unrecognized hero of the Revolution" who was born in Danvers in 1756, enlisted in

[1] See Hist. Coll. Vol. XXVI, p. 1.

Captain Trevett's Marblehead company of artillery immediately after the battle of Lexington. He fought at Bunker Hill where he exhibited a good deal of courage, was with General Knox at the siege of Boston and fought through the war having been wounded at Fort Mifflin. He afterwards fought the Indians in Ohio. In the war of 1812, he was the first to plant the American flag at Detroit. His brilliant achievements in that war gained for him steady advancement in rank.

Monday, Jan. 27, 1890.— Mr. Ezra D. Hines of Danvers delivered an interesting lecture on "The March of Arnold from Cambridge to Quebec" early in the Revolutionary war. He described the condition of things at Cambridge when General Washington first took command of the army. Arnold's plan to capture Quebec was an important one, but was considered bold, yet had the sanction of Washington and other generals. The army left Cambridge in two battalions Sept. 13, 1775, one under the command of Lieut. Col. Christopher Greene and the other under Lieut. Col. Roger Enos. The battalions followed each other a few hours apart and travelled over the old Ipswich road to Newburyport. Arnold himself followed two days later. From Newburyport the army proceeded in vessels to the mouth of the Kennebec. Here they separated into divisions, a squad of ten men under command of Lieut. Archibald Steele going in advance of the main army. The army proceeded in batteaux up the Kennebec and over carrying places until they reached the great carrying place from the Kennebec across to the Dead river; up the Dead river to another great carrying place and then to the height of land separating the waters running south into the Atlantic from those running north into the St. Lawrence; over this and on to Chaudiere pond, then on

and around the Chaudiere river through Canada to Point Levi opposite Quebec. From here they crossed the St. Lawrence to Quebec, ascending the plains of Abraham and remaining there for a short time; then proceeding up the river to Pointe-aux-Trembles, where they were afterwards joined by General Montgomery; the two armies then proceeded up the river and attacked Quebec where Montgomery was killed, Arnold wounded and many of the soldiers killed, wounded or taken prisoners; and what was hoped to be a victory was turned into a defeat. Had Arnold been successful in this expedition, it might perhaps have so changed subsequent events that he would not have been a traitor to his country.

Monday, Feb. 3, 1890.—Rev. Charles B. Rice of Danvers lectured this evening on "Aluminum—Prose and Poetry." He stated that the metal was very abundant, but so mixed with oxygen that it was hard to be got out. It used to be worth $100 per pound. Many of the precious stones are largely composed of aluminum, as sapphire, ruby, topaz, moonstone, etc. It is also in many common minerals and earths; a ton of good clay might contain from $600 to $800 worth of it.

The progress that has been recently made in separating aluminum from other metals and its great abundance have led some enthusiasts to predict that we are on the verge of an "aluminum age," and that great possibilities with the metal lie before us but just what possibilities remain to be seen. It is very light for a metal, about the same weight as an ordinary stone.

It does not rust, is not affected by sulphur or acid, does not tarnish, and is not poisonous. Its strength is much less than iron. It is not easily worked and does not take hard or soft temper like steel; so that it looks as if "the

goddess of industry would continue to wear the iron crown."

It is now chiefly worked as an alloy, its combination with copper making a compound much stronger and more elastic than either metal. It is mixed with copper in the proportion of one to ten. It has also been used in this alloy to imitate gold chains and watch cases, and wears well without tarnishing. As a bronze it is used for cannon, sheathing vessels, in dynamos and other electric appliances, and is the material used for the cap of the Washington monument.

Monday, Feb. 10, 1890.—Col. Henry Stone of South Boston lectured on the character and career of Major General George H. Thomas. General Thomas was a native of Virginia, and proud of his state. Graduated at West Point number twelve, in a class of forty-two, General Sherman and General Lee being of the same class, Sherman ranking six. He served in the Florida and in the Mexican war with high honors. On the breaking out of the civil war, he refused high rank in the Confederate service, cut aloof from his closest associations, was pronounced an alien enemy by the legislature of his native state, and his property confiscated.

The lecturer traced Thomas' course through the civil war, referring to his brilliant defeat of a confederate force of twice his numbers at Mill Spring. At Chickamauga, his gallant fight against great odds, and the maintaining his position, won for him the recognition he had so long deserved. Immediately after, he succeeded to the command of the forces at Chattanooga, and held the place through a most trying siege which ended in the sweeping away the enemy from Missionary Ridge in a brief and heroic action on Thanksgiving day, 1863.

General Thomas' command did the heavy work in the advance upon Atlanta where he lost thirty-two per cent of his sixty thousand men. Then he turned back to Nashville, Tenn., being closely followed by Hood, and soon after arriving in that city, where he was reinforced by fifteen thousand of Grant's men, he attacked Hood's army and in a short engagement so demolished the enemy that it did no further effective service as an army. For this he was promoted to the rank of major general by the secretary of war, and here ended his military career in the field, though he planned important campaigns in Georgia and Alabama. He was a great favorite with the lecturer who had opportunities of knowing his character, having at one time been on his staff.

General Thomas was mentioned in connection with the Presidency in 1868 but promptly declined to have his name used for such a purpose.

Professor F. W. Putnam of Cambridge, delivered a lecture on "Pre-Columbian America," or the race of men which existed in America before the coming of Columbus. The lecturer said that there were people here long before the discovery of Columbus, and it had long been a question who they were, and whence they came. They, or one stock of them, probably were the descendants of men who, ages before, came from very nearly the same place from which the great discoverer started and so when he sent some of those whom he called Indians, but really the Caribs, back to his own home, he was simply sending them almost to the starting point of their race. Mr. Putnam alluded to the glacial period and the immense gravel deposits following it, and in those gravel banks were found implements and traces of a human race, showing that man existed thousands and tens of thousands of years ago, here in America. He differed from the generally accepted the-

ory that these people with their more than eighty distinct languages, all sprang from one race. There was one type on the Pacific coast which had developed and attained a high mental culture long before the other and different race had shown itself on the Atlantic coast.

There is the strongest evidence that people were living south of the great glacial belt, at the period of the gravel deposits with the Mastodons and Mammoths.

The Professor illustrated his lecture by many excellent lantern pictures including views of the skeletons of the longheaded type of the human race which occupied the northeastern coast, and were found a few years ago buried at Winthrop, Mass. He placed the time of these burials at from 1620 to 1630. In the vertebra of one was found a brass-headed arrow the head of which had penetrated the bone. This brass head indicated contact with the whites.

Monday, March 3, 1890.—Hon. William D. Northend delivered a lecture on the administrations of Conant and Endicott. The lecturer began by saying that the terms used to distinguish the first settlers of the Massachusetts Bay Colony from those of Plymouth were misleading—Puritans and Pilgrims. The term Puritan had been applied to the non-conformists, the separatists, the presbyterians under the long parliament and the independents under Cromwell, and the word pilgrim had no significance in explanation of the religious views of the settlers of Plymouth. They were separatists and the settlers of Salem and Boston were non-conformists, and these were the terms he should use in reference to the different settlements. He described the class known as separatists or Brownists, from the name of Brown, their founder. They differed essentially from the non-conformists in that they

refused to acknowledge the supremacy of the national church, withdrew from its attendance and set up a separate worship in conventicles of their own. The conformists and non-conformists united in opposition to this class as tending to disorder and faction. The lecturer said, in describing the non-conformists, that they detested the forms and ceremonies of the established church as adopted from the Roman church, and to the bishops' courts and the court of high commission through which their observance was empowered. They claimed that these forms and ceremonies were not authorized by scripture — that they were the inventions of men, and that to observe them was idolatry; but this did not affect their regard for a loyalty to the church itself. They were members of it. They subscribed fully to its doctrines and to the ecclesiastical unity upon which it was based. In all essentials they were sincere churchmen, and they did not love the church itself less because of obnoxious forms and ceremonies imposed upon it. They lived in an age when it was the general belief that it was impossible for different sects to exist in the same community without such conflicts as would endanger the peace not only of the churches but of society. The day of toleration had not dawned. To them toleration was not only mischievous but sinful.

The lecturer gave an interesting account of the settlement of Cape Ann made by a company from Dorchester, England, who for some years had been engaged in fishing on the New England coast. The fishing experiment not proving successful, and the land at Cape Ann not being suitable for planting, Conant in the fall of 1626 removed to Salem, "a pleasant and fruitful neck of land," under encouragement of Rev. John White of Dorchester, England, who took great interest in the enterprise. Endicott came over from England in 1628 with a company and took

charge of the settlement. A charter was obtained in 1629 from King Charles to the company, giving powers of government. Encouraged by the new grant from the king, large additions were made to the company by non-conformists from different parts of England, including many of the gentry and wealthy merchants, with a view to a large emigration. Winthrop was elected governor and large preparations were made for the great emigrations which took place in the spring of 1630, when some fifteen hundred people came over. In regard to the establishment of an Independent church here, Mr. Northend said it was with the knowledge and consent of the king.

Monday, March 17, 1890.—Mr. James F. Almy delivered a lecture upon "The Quaker ascendancy in the town of Adams, Mass." The Quakers of Cape Cod and Providence Plantations went to Adams from 1776 to 1800, buying out the original settlers. Many of these Quakers were of illustrious English ancestry. They brought with them to Adams a home life which was perfect, for its division of labor rendered them independent of every other home. They could make everything they needed. The adult membership of the society was over one hundred, and the affiliated membership was twice as great. The children of Friends are members of the society by right of birth. The Friends started a free school system there. At Adams they found conditions very different from those of our day. No progress had been made in manufactures. It was an age of handicraft when every home was a scene of constant, intense industry; every family must produce everything necessary to itself, when the land produced not only the food, but the staples for clothing. The women spun and wove the flax and wool, dyed the web and made the garments, while carrying on the thousand interests of

the household, including the dairy. The men were engrossed in the outside cares of the farm and home, yet maintained high intelligence and character. The lecturer said the Quakers of Adams maintained the first successful cotton factory in America. The Arkwright invention, now about 100 years old, was brought to America in Samuel Slater's brain in 1789. Hearing that a firm in Rhode Island had made some attempts at cotton spinning, he wrote from New York, and received the following as part of his answer: "If thou canst do this thing, I invite thee to come to Rhode Island and have the honor and the profit of introducing cotton manufacturing in America." Slater did enter the firm of Wm. Almy and Smith Brown and with them began the successful era. The Quakers of Adams were the first to set up successful cotton manufacture outside of Rhode Island. Their social life was simple and pure.

Monday, March 24, 1890.— Sidney Perley, Esq., of this city, delivered a lecture on "Old-time winters in Essex County," a subject to which he had given special attention, and had gathered a large fund of information from old diaries, records and newspapers. The lecturer spoke of the watch, church services, dress, food and schools of the early winter seasons; how the people spent their evenings, the winter employment of the people in cutting off the forests, sledding timber and wood, making pipe staves and barrel hoops, and most interesting of all, the institution of the old-fashioned shoemakers' shops, of which nearly every farm had one a century ago. Women in those days engaged in spinning and weaving. The holidays were referred to—Thanksgiving, Christmas and New Year's, and the winter pleasures, such as sleighrides, dancing, spinning and quilting parties, and games, shuffle-

board, coasting, skating, trapping, gunning, fishing, singing schools and girls' samplers. He also spoke of the old modes of travel, snow shoes, etc. Nearly all the heavy teaming was done on sleds, and he mentioned the winter of 1768–9, when the travelling was so bad that the farmers in the western part of the state could not get their grain and provisions to the coast to market. Snow remained on the roads as it fell until about a century ago. Mr. Perley then spoke of particular winters: that of 1641–2, when the Indians said they had not seen the ocean so much frozen for forty years: of 1646–7, when there was no snow to lay; of 1696–7, said to be the coldest winter since the first settlement of New England; of 1701–2, which was "turned into summer;" of 1717–18, when the snow was from ten to fifteen feet deep and the drifts twenty-five feet, many one-story houses being buried; of 1740–1, said to be the severest winter known by the settlers, Salem harbor being frozen over as early as October; of 1774–5, a wonderfully mild winter; of 1779–80, when for forty days, including March, there was no perceptible thaw, and the snow was so hard and deep that loaded teams passed over the fences in any direction, arches being dug under the snow so that men on horseback could ride under them, and which was long remembered as *the* hard winter; of 1784–5, when, as late as April 15, snow was two feet deep, and frozen hard enough to bear cattle; of 1785–6, when in the remarkable storm of Nov. 25, the snow blew into balls, one of which had rolled seventy-six feet, measuring 17½ by 22 inches; of 1794–5, when the Betsey was launched in Salem on Christmas Day, the thermometer indicating 80 degrees above zero at noon and men and boys went in swimming; of 1801–2, when the *Ulysses*, *Brutus* and *Volutia*, three Salem vessels, which sailed out of the harbor on a summer-like morning in February, were all

cast away at night on Cape Cod, in a terrible snow storm, which continued a week. He also referred to more recent seasons, and of the cold winter of 1856–7, when in one week in January was the coldest day by the thermometer ever recorded of late years, mercury in Salem 20 below zero. Travel on the railroad between Boston and Salem entirely suspended from Tuesday morning to Thursday afternoon. The recent mild winters were also alluded to. The lecturer exhibited an interesting diagram which he had prepared, showing at a glance the comparative severity and mildness of each winter from 1629 to the present time.

Monday, March 31, 1890.—Mr. George G. Russell of this city read a paper on his experiences at the Andersonville prison in 1864. He was captured at the battle of the Wilderness and was a prisoner eight months, four of which he spent in "Andersonville," then under the charge of Gen. J. H. Winder, commander of the "confederate" prisons, to whom, no doubt, were due the sufferings of the Union men in those prisons. At the close of the war General Winder died from disease contracted in one of those southern prisons.

Monday, April 7, 1890.—Mr. Robert Rayner of this city read a paper on "Means of Communication." The lecturer said that these were a criterion of the civilization of a country, and good artificial means are found where the civilization is high and good. In one hundred and fifty years great progress has been made, but only in the last half of that period has land communication become general. The ancient Romans built fine roads, views of which remain to this day. They generally made them of concrete three feet in depth. It was thought their durability was partly owing to the lime used which remained, after

being slacked, in pits for a period of three years. After the decline of the Roman empire, road-making came practically to an end, although McAdams succeeded in making some fine roads in England and elsewhere. Railroads were introduced in 1825, with George Stevens as an engineer; the speed from eleven to twelve miles an hour, with an outrider on a horse to warn the people of the approach of a train. The aim has been to cheapen transportation, and to-day it is less than one cent per mile for a ton.

In the United States, the improvements for travel began with canals; canal speed is limited and there are now few canals much used. The Ganges canal in India is the greatest, being about 1,000 miles in length. The lecturer spoke of the various projects for communication in Europe, Africa and America and gave a number of interesting facts and statistics in illustration of his subject.

Monday, May 5, 1890.—Prof. John Ritchie, jr., of Boston read a paper on "Ramie and Flax," a new industry for our New England mills. The *Salem Gazette* says, "The subject has special local interest from the fact that the process of converting it into a commercial article was originated by Mr. Charles Toppan of this city." Many samples of ramie in the form of raw material were shown and gave evidence of what might be accomplished with the stuff.

Ramie is the inner bark of a shrub and is no new material, the cloth in a crude form having been used for wrapping up mummies thousands of years ago. It was introduced into this country and England about the year 1800.

The lecturer spoke of the various difficulties in manufacturing, of removing the bark, the ungumming of the fibre and the special material for spinning. Mr. Toppan's

process ungums the fibre and renders it possible to spin it on ordinary cotton and woollen machinery, but the process of removing the bark still remains unsolved; the imported material comes prepared.

The additions to the library for the year (May, 1889, to May, 1890) have been as follows:

By Donation.

Folios,	50
Quartos,	173
Octavos,	930
Twelvemos,	665
Sixteenmos,	209
Twenty-fourmos,	84
Total of bound volumes,	2,111
Pamphlets and serials,	9,120
Total of donations,	11,231

By Exchange.

Folios,	72
Quartos,	31
Octavos,	212
Twelvemos,	9
Sixteenmos,	5
Twenty-fourmos,	1
Total of bound volumes,	330
Pamphlets and serials,	3,510
Total of exchanges,	3,840

By Purchase.

Folios,	3
Quartos,	2
Octavos,	71
Twelvemos,	18
Sixteenmos,	5
Total of bound volumes,	99
Pamphlets and serials,	776
Total of purchases,	875
Total of donations,	11,231
Total of exchanges,	3,840
Total of purchases,	875
Total of additions,	15,946

Of the total number of pamphlets and serials, 3,787 were pamphlets and 9,619 were serials.

The donations to the library for the year have been received from two hundred and seven individuals and seventy-five societies and governmental departments. The exchanges from eight individuals and one hundred and seventy-eight societies and incorporated institutions, of which ninety-four are foreign; also from editors and publishers.

Among the donations may be mentioned an addition to the botanical section of nearly 100 volumes, from Mr. John Robinson; about 600 volumes distributed among the various departments, from Mr. T. F. Hunt; the frequent gifts of Dr. Samuel A. Green of Boston; and the congressional documents regularly received from the Department of the Interior.

The librarian desires to call attention again to a subject which was mentioned in his last annual report, namely, the marking out of special lines of work for the Public Library and the Essex Institute, and in a lesser degree for the Salem Athenæum, and the Peabody Academy of Science. A few months since a meeting was held at the Public Library, at which were present representatives of all the societies mentioned and a unanimous agreement was arrived at, that each should as far as possible mark out a special line of its own in reference to the purchase of expensive books so that unnecessary duplication would be avoided. To the Public Library should be left the purchase of books on general literature as fiction, biography, travels, etc., and those on the industrial and mechanic arts; to the Institute, local history, genealogy, sociology, the collection of bound volumes of newspapers and other subjects within the line of its special work and, together with the Peabody Academy of Science, the scientific works largely obtained by

exchange; while the Athenæum which is less public in its character than the others, not confining itself to any special line, except perhaps its foreign scientific publications, would gain by not being obliged to duplicate the costly books to be found in the other libraries. It was also agreed by the conference, that the librarian of the Public Library should be authorized to issue a card addressed to the librarian of either of the other libraries which would entitle the holder to consult any work of reference on the shelves of those institutions. The benefit to be derived from such an arrangement will grow more and more apparent as the years go by. It is already becoming a serious problem how to properly dispose of the growing accumulation of books especially in our larger cities where space means money and sometimes a good deal of money. No library, not even the largest, can expect to be complete enough to meet the wants of all classes. But if the different libraries will work in unison each striving to make as complete as possible its own specialties much greater and better results will be attained. In this connection it would be well if the donors of books to the various libraries would understand, that unless there were some request to the contrary, their donations, to whichever library sent, would be distributed among the other libraries in accordance with this plan of specialization.

It is hoped that the coming year may see some further progress made towards preparing for a catalogue of the library. During the past year considerable work has been done in arranging and classifying the books in the different rooms and when this is completed, a card catalogue of each room should be prepared, as a beginning for a complete catalogue of the whole library.

The attendance at the rooms of the library has increased during the past year and the librarian hopes that the time

is not far distant when the funds of the Institute will allow it to follow the good example of the Public Library and Peabody Academy of Science and open its rooms to the public on the afternoons of Sunday and during the winter evenings.

CHAS. S. OSGOOD,
Librarian.

Donations or exchanges have been received from the following sources:

	Vols.	Pam.
Adelaide, Royal Society of New South Wales,	1	
Albany, New York State Library,	1	
Almy, James F.,	18	1
Alnwick, Eng., Berwickshire Naturalists' Club,		1
American Association for the Advancement of Science,	1	
Ames, George L.,		1
Amherst College,		1
Amherst, Massachusetts Agricultural College,		7
Amherst, Massachusetts Agricultural Experiment Station,	3	30
Amiens, Société Linnéenne du Nord de la France,	1	12
Anderson, Mrs. John M., Newspapers,		
Andover Theological Seminary,		1
Andrews, Charles H.,	44	136
Andrews, John P., Newspapers,	1	39
Andrews, Samuel P.,	1	35
Andrews, William P.,		23
Appleton, Francis H., Peabody,	1	
Appleton, William S., Boston,		3
Archer, Augustus J.,	8	
Arey, Mrs. Charles,	1	
Arey, Rev. Charles,	39	
Arvedson, George,	2	19
Association of Medical Officers of American Institutions for idiotic and feeble-minded persons,		1
Atherton, George W., State College, Pa.,	1	
Atwood, F. S.,	1	
Averill, James W.,	1	
Baltimore, Maryland Historical Society,	2	
Baltimore, Md., Johns Hopkins University,		9

Baltimore, Md., Peabody Institute,		1
Banvard, Mrs. J., Neponset,		2
Basel, Naturforschende Gesellschaft,		1
Batavia, K. N. Vereeniging in Nederlandsch Indië,	1	
Belfast, Naturalists' Field Club,		2
Bemis, Miss Caroline E., Newspapers,		
Bergens Museum,		1
Berkeley, University of California,	1	5
Berlin, Gesellschaft der Naturforschende Freunde,	1	
Berlin, Verein zur Beförderung des Gartenbaues,		24
Bern, Naturforschende Gesellschaft,		1
Bologna, R. Accademia delle Scienze,	1	1
Bonn, Naturhistorischer Verein der Preussischen Rheinlande u. Westphalens,		2
Bordeaux, Société Linnéenne,		1
Boston, American Academy of Arts and Sciences,		1
Boston, American Congregational Association,		2
Boston, Appalachian Mountain Club,		1
Boston Board of Health,		14
Boston, Church Home for Orphan and Destitute Children,		1
Boston, City of,	5	
Boston City Hospital,		1
Boston, Massachusetts General Hospital,		1
Boston, Massachusetts Historical Society,	2	1
Boston, Massachusetts Horticultural Society,		3
Boston, Massachusetts Humane Society,		1
Boston, Massachusetts Medical Society,		1
Boston, Massachusetts School for the Feeble-minded,		1
Boston, National Association of Wool Manufacturers,		4
Boston, New England Historic Genealogical Society, Newspapers,	113	212
Boston Public Library,	2	2
Boston Society of Natural History,		8
Bowditch, Henry I., Boston,		1
Bowker, George and Charles,	3	
Boynton, John F., Syracuse, N. Y.,	1	2
Bremen, Naturwissenschaftlicher Verein,		1
Bristol (Eng.) Naturalists' Society,		2
Brooklyn (N. Y.) Library,		1
Brooklyn, N. Y., Pratt Institute,		1
Brooks, Miss E. M. R.,	1	
Brooks, Henry M., Newspapers,	4	7
Brooks, Mrs. Henry M., Newspapers,	4	221

Brooks, I. H., Roxbury,		1
Brooks, Miss Margarette W.		5
Brown, Mrs. Henry A.,	2	
Browne, Edward C.,	35	508
Brownell, T. Frank, New York, N. Y.,	7	21
Brünn, Naturforschender Verein,		2
Brunswick, Me., Bowdoin College,		1
Bruxelles, Académie Royale,	6	
Bruxelles, Société Belge de Microscopie,		8
Bruxelles, Société Entomologique,	1	
Bruxelles, Société Malacologique,	1	12
Buenos Aires, Sociedad Cientifica Argentina,		9
Buffalo (N. Y.) Historical Society,		1
Burnham, J. H., Bloomington, Ill.,		2
Caen, Académie des Sciences, Arts et Belles Lettres	1	
Calcutta, Geological Survey of India,		4
Calcutta, Indian Museum,		2
Caldwell, Rev. Samuel L., Providence, R. I.,		1
Callendar, Hugh L., London, Eng.,		3
Cambridge, Harvard University,		4
Cambridge, Museum of Comparative Zoölogy,	1	11
Canada Royal Society,	1	
Casey, James C.,	1	
Cassel, Verein für Naturkunde,		2
Chadwick, John C., Newspapers,	9	4
Chamberlain, James,	23	215
Chamberlain, Estate of the late Samuel,	59	145
Champaign, Illinois State Laboratory of Natural History,		3
Chapel Hill, N. C., Elisha Mitchell Scientific Society,		2
Chapel Hill, University of North Carolina,		1
Chase, Henry A.,	4	1
Chever, Edward E., San Francisco, Cal., Newspaper,		
Chicago (Ill.) Historical Society,	1	
Chicago, Ill. Newberry Library.		1
Chicago (Ill.) Public Library,		12
Chicago, Rock Island and Pacific Railway Co.,		1
Christiana, Videnskabs Selskabs,		14
Cincinnati, Historical and Philosophical Society of Ohio,		1
Cincinnati, Ohio Mechanics' Institute,		1
Cincinnati (O.) Public Library,		2
Cincinnati (O.) Society of Natural History,		4
Clarke, Mrs. N. A.,	29	76
Cleveland, Miss Lucy H.,		14
Cleveland, Mrs. William S.,	21	

Cleveland, O., Western Reserve Historical Society,	1	
Cogswell, William,		3
Columbus, Ohio Agricultural Experiment Station,		2
Conant, W. P., Charleston, S. C., Newspapers,		
Cooke, Mrs. H. Ruth, New York, N. Y.,	1	
Cooke, James P., Cambridge,		1
Copenhague, Académie Royale,		1
Copenhague, Société Royale des Antiquaires du Nord,		3
Cordoba, Academia Nacional de Ciencias,		1
Cox, Francis,		96
Culin, Stewart, Philadelphia, Pa.,		1
Curwen, George R.,	6	21
Curwen, James B., Newspapers,		39
Cutter, A. E., Charlestown,		1
Dakota, Department of Immigration and Statistics,		2
Dana, James D., New Haven, Ct.,		1
Daniels, Mrs. C. H., Newspapers,		
Danzig, Naturforschende Gesellschaft,		1
Darmstadt, Verein für Erdkunde,		2
Deerfield, Pocumtuck Valley Memorial Association,	1	
Detroit (Mich.) Public Library,		1
Dodge, James H., Boston,	1	
Dorsey, George W. E., Washington, D. C.,		1
Dresden, Naturwissenschaftliche Gesellschaft "Isis,"		2
Dresden, Verein für Erdkunde,		1
Dublin, Royal Irish Academy,	1	10
Dublin Royal Society,		8
Edes, Henry H., Charlestown,		1
Endicott, Charles,	1	1
Erlangen, Physikalisch-Medicinische Gesellschaft,		1
Essex (Eng.) Field Club,		7
Exeter, N. H., Phillips Academy,		1
Falmouth, Eng., Royal Cornwall Polytechnic Society,	1	
Farmer, Miss Sarah J., Eliot, Me.,		1
Firenze, Biblioteca Nazionale Centrale,		26
Firenze, R. Istituto di Studi Superiori,		6
Flint, Albert S., Washington, D. C.,		1
Foote, Caleb,	1	
Foote, Mrs. Henry W., Boston,		1
Frankfurt-a-M., Senckenbergische Naturforschende Gesellschaft,	1	1
Freiburg, Naturforschende Gesellschaft,		6
Fuller, Miss Henrietta F.,	8	
Gardner, Miss Elizabeth B.,		3

Gardner, Mrs. Henry, ... Newspapers,	12	41
Genève, Institut National Genévois, ...	2	
Genève, Société de Physique et d' Histoire Naturelle, .		1
Giessen, Oberhessische Gesellschaft für Natur u. Heilkunde, ...		1
Gilbert, Mrs. S. D., ...	43	65
Gillis, James A., Winchendon, . . Newspapers,		
Goodrich, Mrs. Almira T., Portsmouth, N. H., Newspapers,		
Göttingen, K. Gesellschaft der Wissenschaften, . .	1	
Gould, John H., Topsfield, ...		2
Gove, William H., ...	1	
Green, Samuel A., Boston, ...	111	657
Güstrow, Verein der Freunde der Naturgeschichte, .	1	
Hagerty, Frank H., Aberdeen, S. D., ...	1	
Halifax, N. S., Nova Scotian Institute of Natural Science, ...		3
Halle, K. Leop.-Carolinische Deutsche Akademie der Naturforscher, ...	1	2
Hamburg, Naturwissenschaftlicher Verein, . . .		1
Hammond, Joseph, ...	18	5
Harlem, Société Hollandaise des Sciences, . . .		4
Harris, Miss R. A., ...		3
Hart, Thomas N., Boston, ...		2
Hartford, Connecticut Historical Society, . . .	1	
Hartford, Ct., Trinity College, ...		3
Hassam, John T., Boston, ...	1	
Hazard, Mrs. Thomas G., Narragansett Pier, R. I., .	1	
Henry, Trustees of the late James, Dublin, . . .		4
Hill, Robert E., ...		2
Hitchcock, Edward, Amherst, ...		1
Hobart, Government of Tasmania, ...	2	
Hobart, Royal Society of Tasmania, ...		1
Holden, N. J., ... Newspapers,		
Hopkins, Trustees of Charity of Edward, . . .	1	
Horton, N. A., & Son, ...	168	402
Hotchkiss, Miss Susan V., New Haven, Ct., Newspapers,		
Hunt, T. F., ...	598	163
Huntington, C. P., New York, N. Y., ...		2
Huot, Lucien, St. Johns, P. Q., ...		1
Iowa City, Ia., State Historical Society, ...		4
Iowa City, Ia., State University of Iowa, . . .		1
Ives, Henry P., ...		12
Keyes, Charles R., Baltimore, Md., ...		3
Kimball, Mrs. James, ... Newspapers,	6	26

Kimball, James P., Washington, D. C.,	1	
Kingman, Bradford, Brookline,		1
Kingsley, J. S., Lincoln, Neb.,		4
Kjöbenhavn, Botaniske Forening,		1
Kjöbenhavn, K. D. Videnskabernes Selskabs,		2
Lamson, Frederick,		17
Lander, Henry B.,	1	
Lansing, Michigan State Library,	15	17
Lausanne, Société Vaudoise des Sciences Naturelles,		3
Lee, Francis H., Newspapers,		375
Lee, Mrs. Francis H., Newspapers,		123
Leech, Edward O., Washington, D. C.,	1	
Leeds, Philosophical and Literary Society,		1
Leiden, Nederlandsche Entomologische Vereeniging,		7
LeMans, Société d'Agriculture, Sciences et Arts de la Sarthe,		1
Lesley, Edward, Boston,		10
Lexington Historical Society,	1	
Lieber, G. Norman, Washington, D. C.,		1
London, Royal Society,		11
Lovett, William H., Beverly,		2
Lowell, Old Residents' Historical Association,		1
Lyon, Académie des Sciences, Belles-Lettres et Arts,	5	
Lyon, Société d'Agriculture, d'Histoire Naturelles et des Arts Utiles,	3	3
Lyon, Société Linnéenne,	3	
McDaniel, Rev. B. F., San Diego, Cal.,	1	9
Mackintosh, Newton, Newspapers,	2	
Madison, Wis., State Historical Society,		2
Madrid Observatorio,	3	
Madrid, Sociedad Española de Historia Natural,		3
Manchester, Eng., Literary and Philosophical Society,	1	
Mannheim, Verein für Naturkunde,		1
Manning, R. C.,		571
Marburg, Gesellschaft zur Beförderung der gesammten Naturwissenschaften,		
Marietta, O., Commissioners of national centennial celebration of settlement of,	1	
Massachusetts Club,		1
Massachusetts, Secretary of the Commonwealth of,	6	1
Massachusetts State Board of Health,	1	53
Meek, Henry M.,	18	
Merrill, William, jr., West Newbury,	1	45
Michigan Agricultural College,		20

Middletown, Ct., Wesleyan University,		1
Milwaukee, Wis., Natural History Society,		3
Mitchell, W. E., New York, N. Y.,		3
Montgomery, James Mortimer, New York, N. Y.,		1
Montreal, Natural History Society,		4
Morse, Miss Edith O.,	1	
Morse, Edward S., Newspapers,	28	231
Morse, John G.,		1
Moseley, Edward A., Washington, D. C.,	1	
München, K. B. Akademie der Wissenschaften,		11
Napoli, Accademia delle Scienze Fisiche e Matematiche,	1	12
Nevins, W. S.,	6	26
Newark (N. J.) Free Public Library,	1	4
Newark, New Jersey Historical Society,	23	36
New Haven, Ct., Yale University,		5
New London (Ct.) County Historical Society,		1
Newport, R. I., Redwood Library,		1
Newton, R. Bullen, London, Eng.,		1
New York Central & Hudson River R. R. Co.,		1
New York Forest Commission,	1	
New York, N. Y., Academy of Sciences,		8
New York, N. Y., American Geographical Society,		5
New York, N. Y., American Museum of Natural History,		21
New York, N. Y., Central Park Menagerie,		1
New York, N. Y., Engineering News Publishing Co.,	1	1
New York (N. Y.) Genealogical and Biographical Society,		4
New York (N. Y.) Historical Society,	2	2
New York, N. Y., Huguenot Society of America,	1	1
New York, N. Y., Lenox Library,		1
New York, N. Y., Mercantile Library Association,	17	8
New York (N. Y.) Microscopical Society,		1
Nichols, Andrew, jr., Danvers, Newspapers,		6
Nichols, John H.,		17
Nichols, Mrs. R. Anne, Roxbury,	2	
Nichols, Mrs. Sarah L.,	20	
Nurnberg, Naturhistorische Gesellschaft,		1
O'Hanlon, Rev. John C., Dublin,	1	
Ohio Meteorological Bureau,		12
Ottawa, Geological and Natural History Survey of Canada, Maps,	3	1
Packard, A. S., Providence, R. I.,	1	
Page, Miss Anne L., Danvers,		1
Paine, Nathaniel, Worcester,		2
Palermo, R. Accademia di Scienze, Lettere e Belle Arti,	1	

Palfray, Charles W.,	Newspapers,		1925
Paris, Société d'Acclimatation,			26
Paris, Société d'Anthropologie,			4
Paris, Société des Etudes Historiques,		1	
Patch, Ira J.,		32	66
Peabody Institute, Peabody,			1
Pease, George W.,		86	10
Peet, Rev. S. D., Mendon, Ill.,			5
Peirce, Mrs. B. O., Beverly,	Maps,	18	1
Peirce, Estate of the late Nathan,	Newspapers, Maps,	22	23
Peirson, Mrs. E. B.		1	3
Perkins, Henry A., Philadelphia, Pa.,			1
Perley, Edward L.,			362
Perley, M. V. B., Ipswich,			1
Perley, Sidney,			2
Perry, Rev. Wm. S., Davenport, Ia.,			1
Philadelphia, Pa., Academy of Natural Sciences,			3
Philadelphia, Pa., American Catholic Historical Society,		2	
Philadelphia, Pa., American Philosophical Society,			5
Philadelphia, Pa., Library Company,			2
Philadelphia, Pennsylvania Academy of Fine Arts,			3
Philadelphia, Pennsylvania Historical Society,			3
Philadelphia, Pa., Wagner Free Institute of Science,			1
Philadelphia, Pa., Zoölogical Society,			2
Phillips, Henry, jr., Philadelphia, Pa.,			1
Phillips, Stephen H.,	Newspapers,		13
Plumer, Miss Mary N.,	Newspapers,		5
Plymouth County Bar Association,		1	
Poole, W. F., Chicago, Ill.,			2
Poore, Alfred,			1
Pope, F. L., Elizabeth, N. J.,		1	1
Porter, Rev. Aaron,	Newspapers,		
Portland, Maine Historical Society,		1	2
Portland (Me.) Society of Natural History,			14
Providence, R. I., Brown University,			1
Providence, Rhode Island Historical Society,			4
Providence, R. I., Narragansett Historical Publishing Company,			3
Providence (R. I.) Public Library,			1
Putnam, F. W., Cambridge,		1	2
Rantoul, Robert S.,		6	71
Raymond, Samuel, Brooklyn, N. Y.,		1	
Rayner, Robert,	Newspapers,		
Reeves, J. T., Appleton, Wis.,		1	

Rice, Rev. C. B., Danvers.			1
Richardson, F. P.,	Newspapers,		
Richmond, Virginia Historical Society,		2	
Riga, Naturforscher Verein,			1
Roads, Samuel, jr., Marblehead,			1
Robbins, Jesse,		2	
Robinson, John,	Newspapers,	94	13
Roma, Biblioteca Nazionale Centrale Vittorio Emanuele,			4
Ropes, Mrs. Charles A.,	Newspapers,	26	165
Ropes, Willis H.,		1	1
Russell, John A., San Francisco, Cal.,		1	
Russell, Estate of the late Miss Sarah O.,		7	107
Sacramento, California State Library,		1	
St. Gallen, Naturwissenschaftliche Gesellschaft,			1
St. Johns, N. B., Natural History Society,			1
St. Louis (Mo.) Public Library,			1
St. Paul, Minnesota Academy of Natural Sciences,			1
St. Pétersbourg, Académie Impériale des Sciences,			20
St. Petersburg, Imperial botanical Garden,			1
Salem, Peabody Academy of Science,		23	795
Salem Press,		1	3
Salem Public Library,	Newspapers,	2	39
San Francisco, California Academy of Sciences,		23	9
San Francisco (Cal.) Mercantile Library Association,			1
San Francisco, California State Mining Bureau,		1	
San Francisco (Cal.) Free Public Library,			1
San Francisco, Cal., Southern Pacific Co.,			1
Saunders, Miss Mabel B.,		1	
Shanghai, China Branch of the Royal Asiatic Society,			2
Sheldon, George, Deerfield,			1
Silsbee, George S.,		35	
Silsbee, Mrs. John H.,	Newspapers,		32
Silsbee, Rev. William,			2
Simonds, William H., jr.,			2
Smith, Miss Alice B., Mound City, Ill.,	Newspapers,		
Smith, George Plumer, Philadelphia, Pa.,	Newspapers,	1	1
Smith, Miss Mary Bartlett, Wellesley,			1
South Boston, Perkins Institution and Massachusetts School for the Blind,		1	
Spinney, W. F., Shanghai, China,			1
Springfield, City Library Association,			1
Springfield, Mo., Drury College,			1
Stephens, B. A., Los Angeles, Cal.,			1
Stettin, Entomologischer Verein,		1	

Stickney, George A. D.,	5	
Stickney, M. A.,		1
Stimpson, T. M., Newspapers,		
Stockholm, Royal Academy of Science,	23	7
Stockholm, Société Entomologique,		1
Stone, Arthur R.,	21	1
Stone, B. W., Newspapers.		
Stone, Mrs. Ellen A., East Lexington. Newspapers,	8	26
Stone, Mrs. Lucy, Boston, Newspapers,		
Stone, Robert, Newspapers.		31
Stone, William, Newspapers,	2	7
Storer, Horatio R., Newport, R. I.,		2
Sydney, Linnean Society of New South Wales,		2
Sydney, Royal Society of New South Wales,	1	2
Taunton, Old Colony Historical Society,		1
Taunton, Eng., Somersetshire Archæological and Natural History Society,	1	
Tennessee State Board of Health,		11
Thayer, Rev. G. A., Cincinnati, O.,	4	
Thayer, Oliver,	1	2
Thwing, Walter E., Boston,	1	
Tilley, R. H., Newport, R. I.,		1
Tilton, John P.,		5
Topeka, Kan., Academy of Sciences,	1	
Topeka, Kansas Historical Society,	13	27
Topeka, Kan., Washburn College Laboratory of Natural History,		2
Topinard, P., Paris,		1
Toronto, Canadian Institute,		4
Towne, Mrs. Mary W., New Rochelle, N. Y.,	46	7
Trenton, N. J., Microscope Publishing Co.,		12
Trenton (N. J.) Natural History Society,		1
Tromso Museum,		2
Tuckerman, Frederick, Amherst,		1
Turner, J. Horsfall, Idel, Bradford, Eng.,		1
Turner, Ross,	1	24
Tuttle, Julius H., Boston,		1
Unknown,	38	23
Upton, George,	1	
Urban, Theodore L., Columbia, Pa.,		1
U. S. Bureau of Education,	3	12
U. S. Bureau of Ethnology,	2	
U. S. Chief of Engineers,	5	
U. S. Chief of Ordnance,	1	

U. S. Chief Signal Officer,		6	1
U. S. Coast and Geodetic Survey,		1	9
U. S. Commissioner of Pensions,			1
U. S. Comptroller of the Currency,		1	
U. S. Department of Agriculture,		1	
U. S. Department of the Interior,		103	2
U. S. Department of State,		3	13
U. S. Fish Commission,		2	
U. S. Geological Survey,		2	6
U. S. Life Saving Station,		1	
U. S. National Museum,		2	10
U. S. Naval Observatory,		1	
U. S. Patent Office,		2	55
U. S. Quartermaster General,		1	
U. S. Surgeon General's Office,		1	
U. S. Treasury Department,		1	
U. S. War Department,		10	
Veazey, W. G., Washington, D. C.,		1	
Voorhees, Rev. L. B.,			28
Walker, Benjamin, Lowell,		1	
Walker, Joseph B., Concord, N. H.,		1	
Washington, D. C., Anthropological Society,			5
Washington, D. C., Legacion de la Républica de Costa Rica,			4
Waters, David P.,		52	498
Waters, H. F.,		1	27
Waters, J. Linton,			1
Waterville, Me., Colby University,			8
Watson, Miss C. A., North Andover,			5
Watson, S. M., Portland, Me.,			2
Welch, W. L.,	Newspapers,	35	30
Welsh, Charles H.,		1	
West Newbury Natural History Club,			25
Wheatland, Miss Elizabeth,			7
Wheildon, William W., Concord,			2
Whipple, George M.,	Newspapers,	20	33
Whipple, Prescott,	Newspapers,		91
White, A. P.,			2
Whitehouse, Cope, New York, N. Y.,			1
Whitmore, William H., Boston,		1	
Whitney, Mrs. Henry M., North Andover,	Newspapers,		3
Wien, K. K. Zoologisch-Botanische Gesellschaft,			4
Wiesbaden, Nassauischer Verein für Naturkunde,			1

Wilkes-Barré, Pa., Wyoming Historical and Geological Society,			1
Williams, J. Fletcher, St. Paul, Minn.,			1
Willson, Rev. E. B.,			76
Winnipeg, Historical and Scientific Society of Manitoba,			5
Winsor, Justin, Cambridge,			33
Winthrop, Robert C., Boston,			7
Woodbury, Rev. Augustus, Providence, R. I.,			1
Woods, Mrs. Kate T.,	Newspapers,		1
Worcester, American Antiquarian Society,			2
Worcester Natural History Society,			2
Worcester Society of Antiquity,			2
Wright, Frank V.,	Newspapers,	1	133
Wright, W. H. K., Plymouth, Eng.,			9
Würzburg, Physikalisch-Medicinische Gesellschaft,			2

The following have been received from editors or publishers:

American Exchange and Mart.
American Journal of Science.
American Naturalist.
Beverly Citizen.
Browne's Phonographic Monthly.
Cape Ann Advertiser.
Chicago Journal of Commerce.
Danvers Mirror.
Georgetown Advocate.
Groton Landmark.
Iowa Churchman.
Ipswich Chronicle.
Lawrence American.
Le Naturaliste Canadien.
Lyceum Herald.
Lynn Bee.
Musical Herald.
Musical Record.
Nation.
Naturalist's Leisure Hour and Monthly Bulletin.
Nature.
New England Magazine.
Old New York.
Open Court.
Our Dumb Animals.
Peabody Press.
Peabody Reporter.
Sailors' Magazine and Seamen's Friend.
Salem Gazette.
Salem News.
Salem Observer.
Salem Register.
Traveler's Record.
Voice.
West Newbury Messenger.
Zoologischer Anzeiger.

The donations to the cabinets during the year number four hundred and sixty-four from the following one hundred and twenty-five donors :—

Andrews, Moulton & Johnson.
Arvedson, George.
Averill, James W.
Baker, Charles.
Banvard, Mrs. Joseph, Nepouset.
Brooks, H. M.
Brooks, Mrs. H. M.
Brooks, Miss Margarette W.
Brown, Mrs. Henry A.
Burnham, J. H., Bloomington, Ill.
Campbell, Mrs. Mary F., Plymouth.
Casey, James C.
Chadwick, John C.
Chamberlain, James A.
Chamberlain, Samuel, Estate of.
Chandler, A. W., Hamilton.
Clark, Rev. De Witt S.
Clarke, Mrs. N. A.
Cleveland, Miss Lucy H.
Cleveland, Miss Mary S.
Cleveland, W. S., Heirs of.
Cleveland, Mrs. W. S.
Coffee, James.
Cox, Francis.
Curwen, George R.
Curwen, James B.
Dailey, Peter.
Dennis, William D.
Dolliver, Elizur L., Marblehead.
Dolliver, Polly, Marblehead.
Edes, Henry H., Charlestown.
Estes, George W., jr.
Fessenden, Joseph.
Foote, Caleb.
Foster, E. O.
Fowler, Miss Harriet P., Danvers.
Gardner, Daniel B.
Gardner, Miss Elizabeth B.
Gardner, Mrs. Henry.
Gove, William H.
Green, Samuel A.
Gregory, James J. H., Marblehead.
Hammond, Joseph.
Harris, James.
Hawkes, Nathan M., Lynn.
Higginson, Waldo, Boston.
Hill, Benjamin D.
Hill, William M.
Hotchkiss, Miss Susan V., New Haven, Conn.
Hubon, Henry G.
Hudson, Mrs. Abby M., Roxbury.
Hunt, T. F.
Hutchinson, T. J.
Ireson, Mrs. C. K.
Johnson, Daniel H., New York.
Johnson, E. Frank.
Johnson, Samuel A.
Johnson, Thomas H.
Jones, Gardner M.
Kimball, Miss Elizabeth H.
Kimball, Mrs. Ruth P. S.
Kimball, Miss Sarah H.
Kinsman, Mrs. Wm. L.
Lamson, Frederick.
Lander, Miss Louisa.
Lee, Francis H.
Little, David Mason.
Mitchell, W. E., New York.
Morse, Edward S.
Morse, John G.
Nevins, W. S.
Nichols, John H.
Nichols, John Henry.
Northend, William D.
Oliver, H. K.

Osborne, Miss H. Frances.
Osgood, Charles.
Palfray, Charles W.
Payson, Edward H.
Peabody Academy of Science.
Peirce, Nathan, Estate of.
Philbrick, Misses Eliza and Helen.
Phillips, Mrs. Adeline G., Topsfield.
Phillips, Irving F.
Phippen, George D.
Pierce, Josiah, Washington, D. C.
Plumer, Miss Mary N.
Porter, Rev. Aaron.
Quimby, E. H., Malden.
Rantoul, R. S.
Rayner, Robert.
Rice, Rev. C. B., Danvers.
Robbins, Jesse.
Robinson, John.
Ropes, Mrs. Charles A.
Ropes, James M.
Ropes, Willis H.
Russell, Miss Sarah O., Estate of.
Russell, William.
Salem Gazette, Publishers of.
Salem Hospital, Trustees of.
Saunders, Miss Mabel B.
Saunders, Miss Mary T.
Silsbee, Mrs. John H.
Silsbee, Rev. William.
Simonds, William H., jr.
Skerry, Gideon F.
Smith, George Plumer, Philadelphia, Pa.
Smith, Miss Sarah E.
Steel, Richard C. de la, Baltimore, Md.
Stone, Mrs. Ellen A., Lexington.
Tapley, D. J., New York.
Turner, Ross.
Valentine, Miss M. P.
Waters, Henry F.
Webb, Benjamin.
Welch, William L.
Wheatland, H.
Whipple, George M.
Whipple, Mrs. George M.
Whipple, Prescott.
Whipple, Mrs. S. K., Newburyport.
Williams, Miss Mary E.
Winthrop, Robert C., jr., Boston.
Wright, Frank V.

TREASURER'S REPORT.—Receipts and expenditures of the past year (condensed from the account presented).

RECEIPTS.

For balance of last year's account,		$395 94
" conditional donation from Mrs. Sarah A. Silver,	$1,000 00	
" interest from Five Cents Savings Bank to be funded,	43 38	
		$1,043 38
" assessments of members,	$816 00	
" income of invested funds,	3,084 53	
" sale of publications,	623 01	
" amounts from other sources,	158 45	
Net income,		$4,682 02
		$6,121 34

EXPENDITURES.

By salaries of secretary, assistant librarians and janitor,	$2,043 33	
" cost of books, periodicals and binding,	655 71	
" " " publications and printing,	1,220 23	
" " " fuel,	217 25	
" " " gas and water,	75 42	
" " " repairs,	80 85	
" " " tax on barn,	24 50	
" " " express, postage and sundries,	216 42	
" paid Salem Athenæum, portion of repairs and expenses,	166 80	
" " annuities, obligations with legacies,	710 00	
Net expenses,		$5,410 51
By amount added to manuscript fund,	$32 88	
" " " " North bridge, monument fund,	10 50	$43 38
Balance on hand,		667 45
		$6,121 34

May 19, 1890. Respectfully submitted.
GEO. D. PHIPPEN. *Treasurer.*

Examined and approved.

R. C. MANNING, *Auditor.*

INVESTMENT OF THE FUNDS.

For the Essex Institute building,	$28,370 69
" Ship Rock and land,	100 00
" purpose of income,	61,269 10
Total investment,	$89,739 79

Salem, May 17, 1890.

Examined and found to agree with the securities,

R. C. MANNING, *Auditor.*

Necrology of Members.

William G. Barton, son of Gardner and Ann (Donaldson) Barton, was born in Salem, April 4, 1851; elected a member of the Essex Institute, Jan. 1, 1872 and died in Danvers, Jan. 23, 1890.

Samuel Chamberlain, son of Samuel and Mary (Bowman) Chamberlain, was born in Salem, Jan. 20, 1799; elected a member of the Essex Institute, May 8, 1872 and died in Salem, Sept. 25, 1889.

Mrs. Nancy D. Cole, widow of Thomas Cole and daughter of Joel and Abigail Baker (Davis) Gay, was born in Roxbury, Jan. 19, 1795; elected a member of the Essex County Natural History Society in 1834 and died in Salem, Jan. 13, 1890.

Daniel P. Galloupe, son of Israel and Betsy (Ross) Galloupe, was born in Topsfield, Jan. 20, 1807; elected a member of the Essex Institute, June 11, 1852 and died in Lowell, May 3, 1890.

Henry Gardner, son of John and Mary (West) Gardner, was born in Salem, Sept. 26, 1809; elected a member of the Essex Institute, April 9, 1856 and died in Salem, Jan. 20, 1890.

Dr. Charles Haddock, son of Prof. Charles Brickett and Susan (Saunders) Haddock, was born in Hanover, N. H., July 14, 1822; elected a member of the Essex Institute, May 10, 1848 and died in Beverly, Oct. 10, 1889.

Joseph H. Hanson, son of Tobias and Susan A. (Adams) Hanson, was born in Wakefield, N. H., March 31, 1816; elected a member of the Essex Institute, July 6, 1864 and died Feb. 17, 1890.

JOHN S. JONES, son of William and Elizabeth (Giles) Jones, was born in Salem, July 19, 1824; elected a member of the Essex Institute, Dec. 16, 1867 and died in Salem, Dec. 2, 1889.

JOHN KINSMAN, son of John Choate and Anna (Lord) Kinsman, was born in Ipswich, Sept. 3, 1810; elected a member of the Essex Institute, Feb. 8, 1865 and died in Salem, Nov. 16, 1889.

CHARLES LAMSON, son of Asa and Rebecca (Vickery) Lamson, was born in Salem, Sept. 16, 1817; elected a member of the Essex Institute, July 6, 1864 and died in Salem, March 12, 1890.

JOSEPH W. MERRILL, son of Nathan S. and Sally Merrill, was born in So. Hampton, N. H., Dec. 13, 1819; elected a member of the Essex Institute, Oct. 5, 1874 and died in Cambridge, Nov. 12, 1889.

CHARLES H. MILLER, son of Samuel and Nancy (Brown) Miller, was born in Belfast, Me., Dec. 1, 1819; elected a member of the Essex Institute, March 21, 1870 and died in Washington, D. C., while on a visit there, April 16, 1890.

GEORGE P. OSGOOD, son of John Williams and Sarah (Prince) Osgood, was born in Salem, March 22, 1813; elected a member of the Essex Institute, May 20, 1857 and died in Salem, Nov. 2, 1889.

WILLIAM PICKERING, JR., son of William and Mary (Pettee) Pickering, was born in Salem, July 25, 1838; elected a member of the Essex Institute, Nov. 12, 1886 and died in Salem, July 6, 1889.

WILLIAM D. PICKMAN, son of Dudley Leavitt and Cath-

erine (Saunders) Pickman, was born in Salem, Jan. 6, 1819; elected a member of the Essex County Natural History Society, July 9, 1845, and of the Essex Historical Society, Sept. 8, 1846 and died in Boston, Feb. 28, 1890.

Dr. Henry E. Pope, son of Eleazer and Mary (Nimblet) Pope, was born in Salem, Feb. 16, 1819; elected a member of the Essex Institute, Sept. 16, 1867 and died in Salem, March 7, 1890.

Charles C. Redmond, son of Peter and Nancy Redmond, was born in Solon, Me., April 8, 1850; elected a member of the Essex Institute, Jan. 17, 1887 and died in Salem, Sept. 15, 1889.

Charles A. Ropes, son of Benjamin and Frances (Wilkins) Ropes, was born in Salem, March 14, 1818; elected a member of the Essex Institute, March 8, 1854 and died in Salem, March 19, 1890.

Eleazer Wheelock Ripley Ropes, known as Ripley, son of Benjamin and Frances (Wilkins) Ropes, was born in Salem, Sept. 30, 1820; elected a member of the Essex Institute, March 8, 1854 and died in Brooklyn, N. Y., May 18, 1890.

Mrs. Rebecca A. Silsbee, wife of John H. Silsbee and daughter of Pickering and Rebecca (Jenks) Dodge, was born in Salem, Dec 21, 1819; elected a member of the Essex Institute, July 6, 1864 and died in Salem, April 18, 1890.

Rev. William Silsbee, son of William and Mary (Hodges) Silsbee, was born in Salem, May 17, 1813; elected a member of the Essex Historical Society, Sept. 8, 1846, and of the Essex Institute, March 29, 1848 and died in Salem, Jan. 8, 1890.

HENRY D. SULLIVAN, son of Thomas R. and Charlotte C. (Blake) Sullivan, was born in Boston, June 20, 1841; elected a member of the Essex Institute, Jan. 16, 1888 and died in Paris, while on a journey, Aug. 29, 1889.

A more complete account of some of these members who have been conspicuous in the works of the Institute and of some who have contributed largely to those departments of science and history which are included in the province of the society, will be given in some future number of the Historical Collections.

Date Due

11 May 49