

- - - ANATOMY OF THE PERLA FLAVESCENS. - - -

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Plate I. Dorsal view of *Perla flavescens*.

Plate II. Ventral view of *Perla flavescens*.

Plate III. Dorsal and ventral views, legs and gills.

Plate IV. Antennae and caudal appendage.

Plate V. Mouth parts.

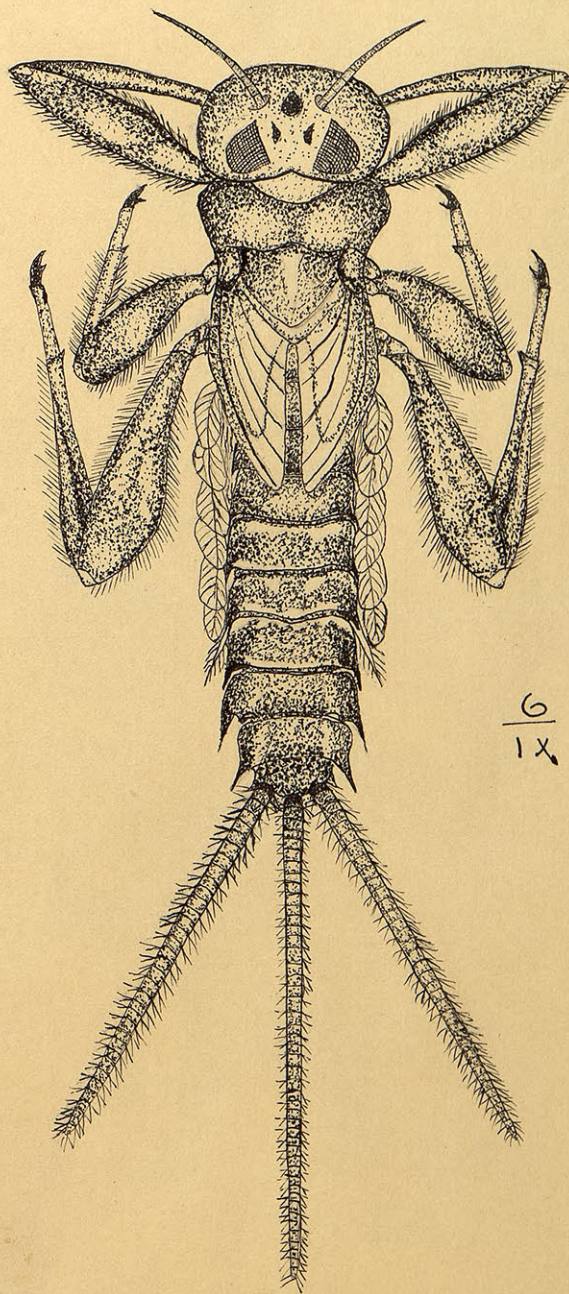
Plate VI. Digestive and nervous systems.

Plate VII. Respiratory system.



PLATE 1.

DORSAL VIEW OF PERLA FLAVESCENS.



$\frac{6}{1x}$

(Blachly)



- - - "ANATOMY OF THE PERLA FLAVESCENS." - - -

### NAME AND CLASSIFICATION.

This little insect is classified differently by authors. Sedgwick in Cambridge Natural History, Vol. V. places it in the order Neuroptera. Suborder Pseudo Neuroptera, families Embiidæ Thermitidae, Psocidae, and Perlidae. Miall places it between the Sialidae and Epimeridae. His classification of families is as follows:- Trichoptera, Sialidae, Perlidae, Ephemeridae, Odonata, Rhynchota, and Podura. Comstock places it in an order by itself, - Plecoptera, family Perlidae, and just above Odonata.

### DISTRIBUTION.

It is an insect but little worked out. Sedgwick says that there are but twenty-four species in Great Britain, and not over two hundred species named in all the collections of the world. But as the Perla is very widely distributed, it is likely that the number exceeds two or three thousand species.

Fossils of the Perlidae have been found in rocks of the carboniferous strata of Commeny, as well as embedded in amber.

### LIFE HISTORY.

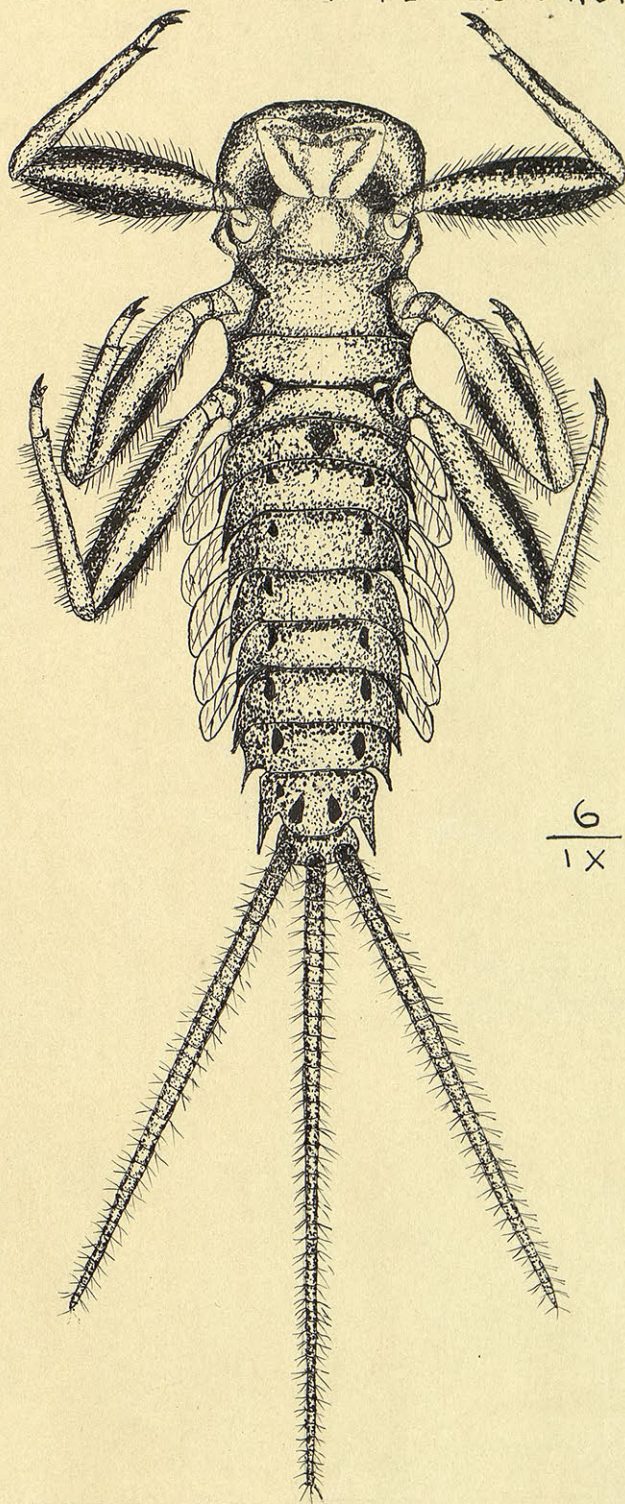
In its life history, it has two distinct and abrupt stages. The longer one, or larva stage, is entirely aquatic, and the second, short, imago stage is aerial. The larva requires a year for its growth, (See Plate I.) breathes with gills, and swims freely by means of its legs which are well provided with swimming hairs. It is carnivorous, living on its near relatives, the Epimeridae.

Swift flowing, foamy streams, such as mountain torrents, are its natural homes. Here they may be found in great abundance in the



PLATE 2.

VENTRAL VIEW OF PERLA FLAVESCENS.



$\frac{6}{1X}$

(BLACHLY)



spring and summer, living under rocks the size of one's hand and larger. On lifting such a rock out of the water, and examining its under surface, you will see them clinging to it, or crawling to the darkest recesses. Both the Perlidae and Epimeridae will be found there.

There are several months during the larva stage. Larva have been known to come to the surface of the ice in freezing weather to cast off their skin, and even the adults have been found on the snow in early spring.

Towards the early part of June, the larva may be seen leaving the water and crawling on stones for a distance of several feet from the water's edge, for the transformation. After firmly fastening its feet to the soil, the old skin begins to swell then slit longitudinally along the dorsal surface. The young skin, tho perfect thruout, is still soft, and may be seen thru the slit. First the head is freed, then the antennae, wings, and legs. After firmly hooking its new feet to the ground, the abdomen and tail filiments are withdrawn. The fly is soft and pale, but soon the organs of locomotion harden and the insect takes flight. The stones along the stream, and above the water's level, can now be seen strewn with the cast off skins of larvas.

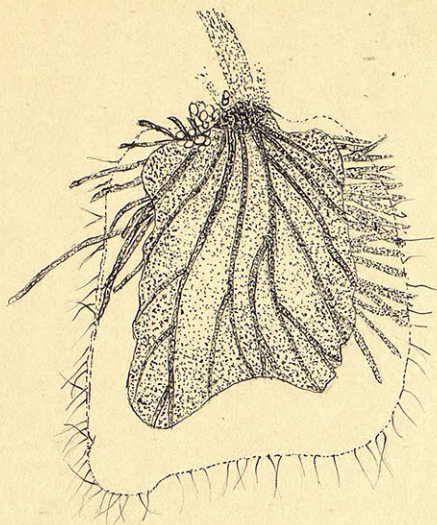
#### MATING AND REPRODUCTION.

The adults mate on ground near the place of emerging, and after the eggs are laid, their life history is complete, and they die. The female lays enormous quantities of small, black, and very peculiarly shaped eggs. Some species, as the *Perla bipunctata* (*bicaudata*) carry their eggs for a while, loosely fastened together, in a transparent sack, at the caudal end of the abdomen.

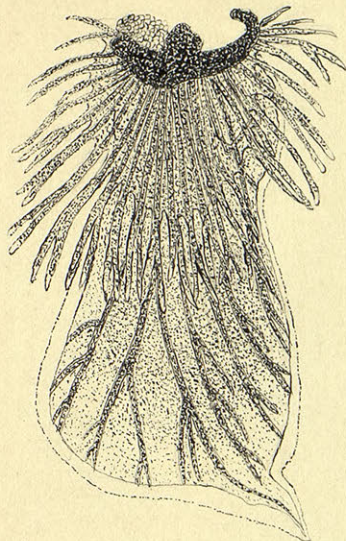
The young larva are very minute, and appear late in the summer and autumn; hiding in the mud in winter, to reappear the next spring.



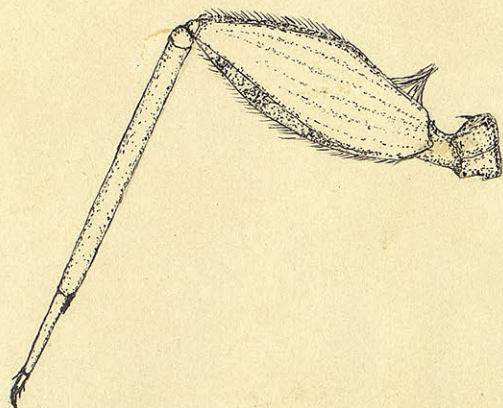
PLATE 3.



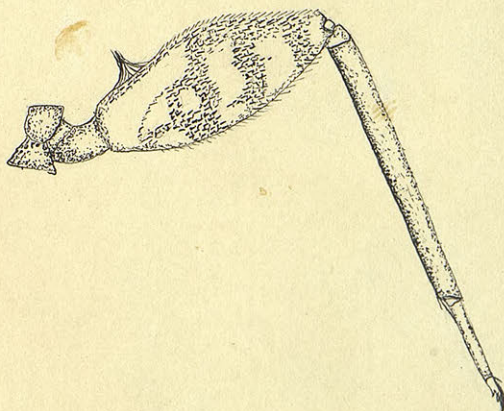
DORSAL VIEW FIRST  
DEXTRAL GILL  $\frac{25}{7} \times$ .



VENTRAL VIEW SECOND  
DEXTRAL GILL  $\frac{26}{7} \times$ .



VENTRAL VIEW  
1<sup>st</sup> SINISTRAL LEG  $\frac{9}{1} \times$ .



DORSAL VIEW  
FIRST SINISTRAL LEG  $\frac{9}{1} \times$ .

(Blasby.)



Both the larva and imago are of a dull stone color. Tho they have comparatively large wings, the Perlidae are poor fliers, unable to avoid obstacles, and capable of but short flights. Consequently, the adults are seldom seen far from the water.

Both the larva and adult insects have long, flexible, many segmented antennae and caudal appendages. Adult insects in repose fold and overlap the wings so that only one wing shows over the back. The costal portion is folded down to protect the body. The adult insect is a little longer than its larva. Plate I.

Plate II. Ventral View, shows the relative position of the mouth parts, which are retracted within the head. The eyes show from the under side, as also do the attachments of the legs to the body.

#### DETAILED DESCRIPTION.

The head is circular in outline, convex, and covered with thick epidermas. There are two compound eyes, and situated between, and in front of them are three ocelli. Near the center of the head and in front of the eyes are two pits from which are born the filiform antennae. These are many segmented, flexible and usually carried cephalad. The longest antennae counted had thirty-two segments. See Plate IV.

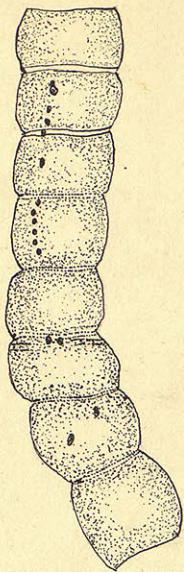
The legs are attached ventrally to the three segments of the body, while the elatera and under wings are attached dorsally to the mesothorax and metathorax. Both dorsal and ventral views of first sinistral leg are given, showing joints of attachment, swimming hairs, and general form. See Plate III.

The gills deserve special mention. Illustrations given of dorsal first dextral, and ventral second dextral, shows difference in shape, size, and arrangement of tracheal tubes. The gills are semi cupshaped, bottom of cup pointing caudalad, and composed of several

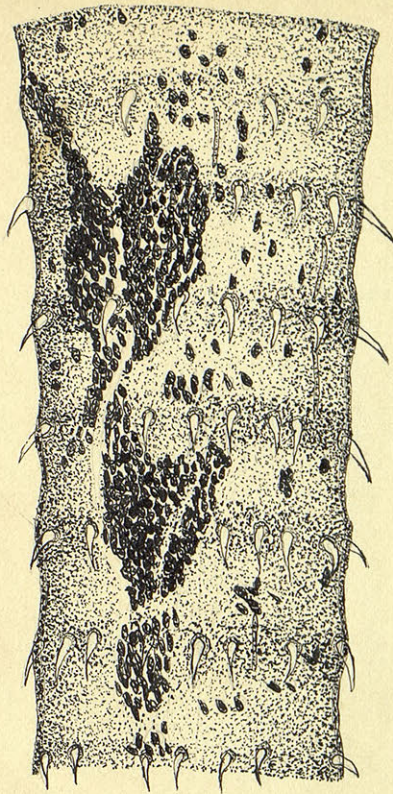




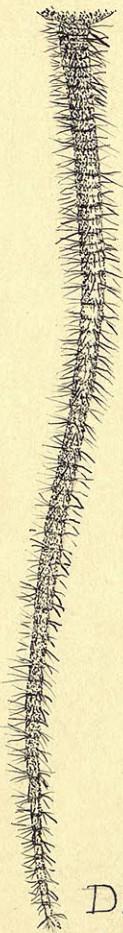
$\frac{25}{7}x$ . DEXTRAL ANTENNÆ  $\frac{25}{7}x$   
6<sup>th</sup> to 14<sup>th</sup> SEGMENTS  $\frac{75}{7}x$ .



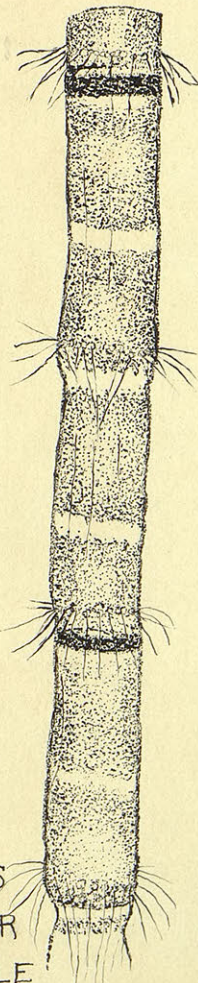
$\frac{75}{7}x$ .



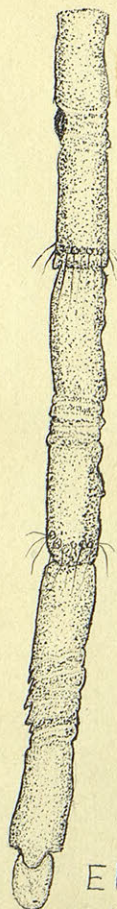
1 TO 7. CEPHALIC SEGMENTS OF  
DEXTRAL CAUDEL APPENDAGE  $\frac{75}{7}x$ .



DEXTRAL CAUDEL  
APPENDAGE.  $\frac{9}{1}x$ .  
79 JOINTS.



SEGMENTS  
FROM NEAR  
THE MIDDLE



END OF  
CAUDEL  
APPENDAGE  $\frac{75}{7}x$ .

(Blachly)



layers, the outer layer transparent, the middle one contains veins, and the inner consists of tracheal filaments. These tracheal filaments are connected directly to the spiracles of the body, the whole gill being attached to powerful muscles which keeps them in constant motion.

"In several species, the filaments persist in imago, so that in these cases we meet with the curious condition of the coexistence of branchiae with a well developed and functionally active system of spiracles. More curious because the insect is entirely aerial." Sedgwick.

But when they do exist, they are shrivelled up, and functionally inactive. Nevertheless the spiracle orifices are not opened as in the case of the Epimeridae. "This goes to prove that the insects were originally terrestrial, and fitted with slits. The growth of gills has been a secondary nature. No organ of the insect is more variable in position, number, and structure than larva gills. This is taken as proof that they are not descended from a common ancestor, but acquired by many small groups independent of each other." Sedgwick.

The abdomen consists of ten segments, the first and second segments coalesced on ventral side. All but the first are armed with spines on lateral edges, pointing caudad. See Plate II.

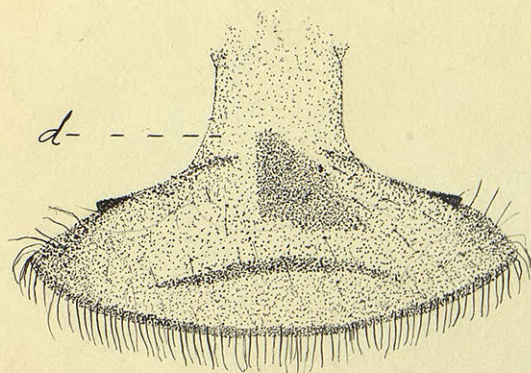
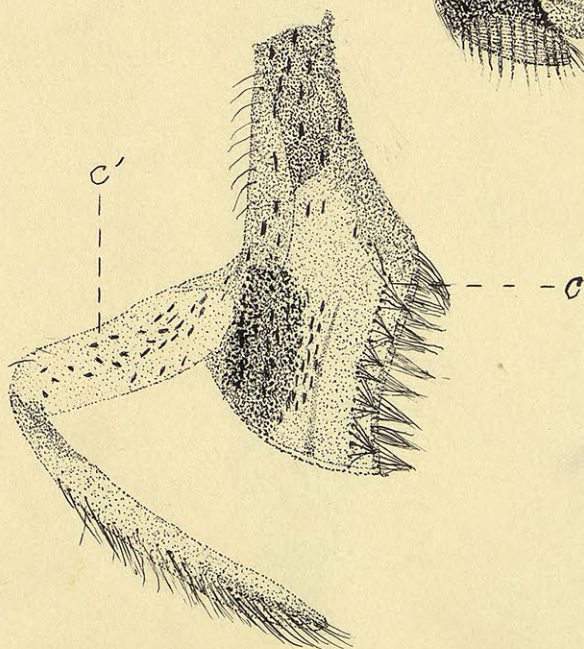
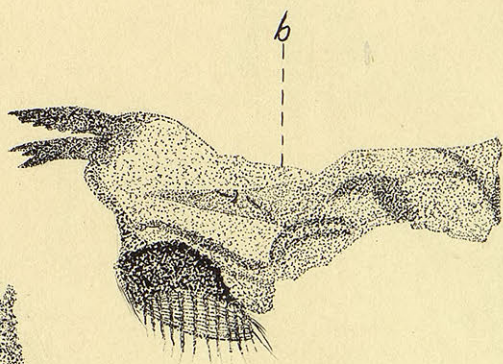
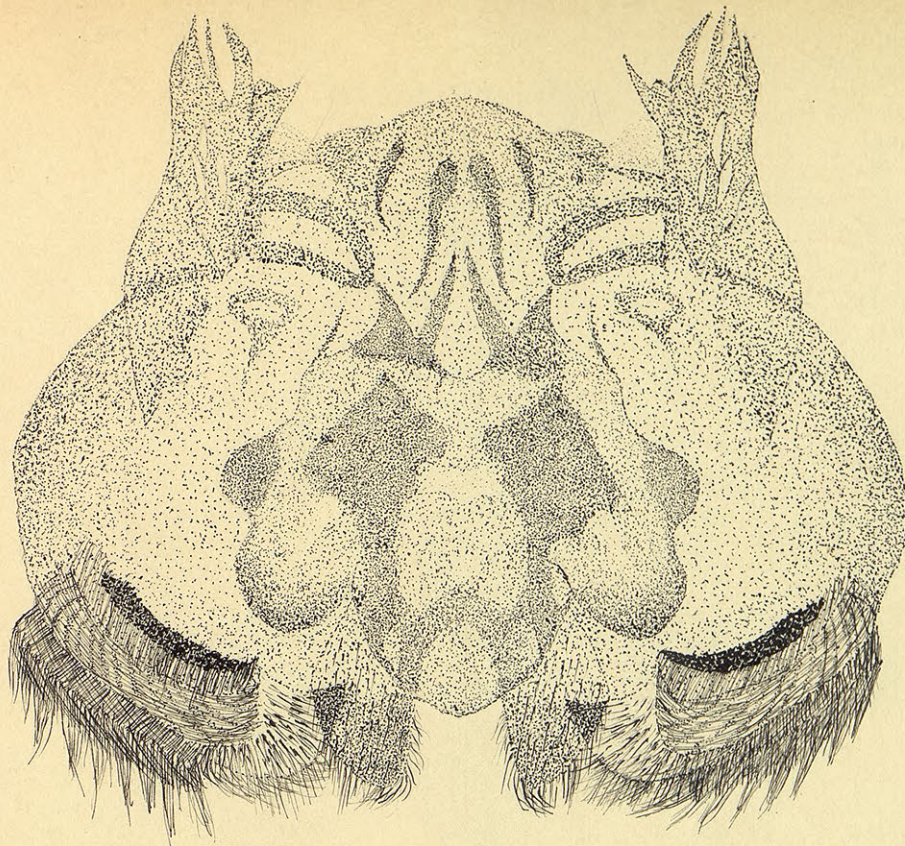
Extending caudad from last segment of abdomen are three filiform appendages, called caudal appendages. See Plate IV. These caudal appendages, like the antennae, are long, flexible, and many segmented. The middle appendage being the longest. The longest appendage counted contained seventy-nine segments.

At the cephalic end of the appendage, and around each joint is a whorl of recurved spines, these soon decrease in size, until they are mere hairs, as is shown in the third drawing. The light and dark areas are also well shown. The very dark spots are the sense organs.

The mouth parts, Plate V, are fitted for biting, and are re-



PLATE 5.

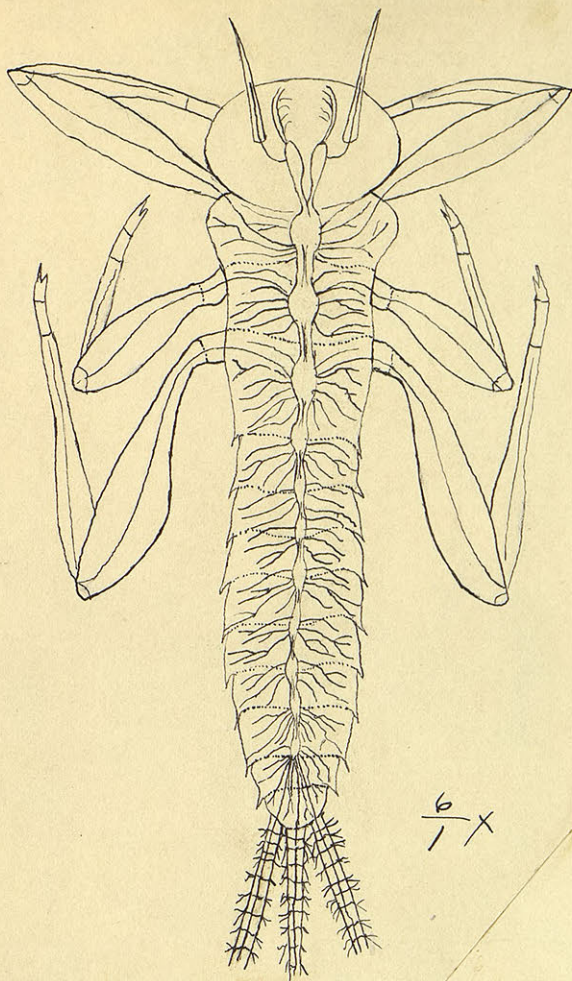


(BLACHLY.)

MOUTH PARTS 25X.

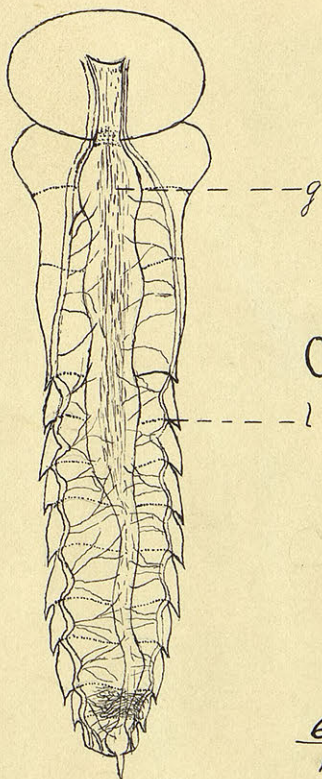


PLATE 6.



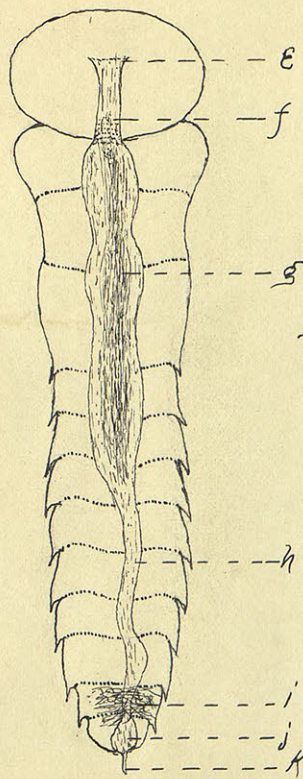
A

$\frac{6}{1} \times$



C

$\frac{6}{1} \times$



B

$\frac{6}{1} \times$

(Blachly)



tracted within the head, as before stated. The labrum(a) is large and stout, having its distal edge covered with hairs, as is also the distal edge of the labium(d). The jaws resemble those of the cockroach or beetle, the mandibles(d), small, stout, and armed with small pointed teeth. Maxillae(c) small, well provided with hairs on distal edge, and having well developed palps,(c) which exerted from mouth.

In cast off skins of *Perla* larva, may be seen folds of the intergum folded to form the mouth and spiracles. This fact goes to show that the internal anatomy is formed by infolding of the epidermis.

Plate VI (B) shows the digestive system of *Perla flavescens*. After removing the wings and legs, it was cut open dorsimenson and pinned down on cork. After removing the adipose tissue and mass of eggs, the alimentary canal was seen. Its muscular attachments were not made out. The canal itself was comparatively straight. The different parts named in order are (e) pharynx, (f) oesophagus, (g) stomach, (h) small intestine, (i) Malpighian tubes or vessels, and (j) rectum. As uric acid is found in the Maepighian vessels, it is supposed they serve the office of kidneys.

Lying ventral of the alimentary canal, is the nervous system. (A) It consists of a double row of nerves, knotted at intervals to correspond to the different segments of the body, and extending from the head to near the caudal end of the abdomen. These enlargements or knots are called ganglia, and from these ganglia arise nerves which run to different organs of the body. Those of the head supply nerves to the mouth and antennae; the thoracic ganglia, to the legs and wings, the first six of the abdomen, to the ever actively moving gills, (also see Plate III.) while the last ganglion branches off into the caudal appendages.

These nerves are motory principally, but serve a secondary use as sensory. The head has two small ganglia, the thoracic region has



three larger ones, while the abdomen has eight.

(C) shows the respiratory system. To keep from injuring as much as possible this system, the insect is opened ventrally. Lying lateral of the alimentary canal, and attached ventrad at each segment of the abdomen where the gills open into them, are the tracheal tubes. (1) These tracheae send off numerous branches, which ramify in all directions inside the body wall. Many of them penetrate or envelope the alimentary canal, thus assisting in holding the canal in place.



- - - BIBLIOGRAPHY. - - -

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1. "The Elements of Insect Anatomy."

Comstock and Kellogg.

Method for Laboratory work, and scientific terms.

Pp. 1- 7, 28- 46.

2. "A Manual for the Study of Insects." Comstock.

Various References and names.

3. "Natural History of Aquatic Insects." Miall.

Perliadae. pp 279 - 284.

4. "The Cambridge Natural History." "Vol. V". Sedgwick.

Perliadae. pp 398 - 408.

5. "Guide to the Study of Insects." Packard.

Comparison of Mouth Parts.