THE LABIA OF THE ODONATA.

In the selection of this subject for investigation I was influenced primarily by the lack of knowlege in regard to two important aspects of the study of this remarkable appendage. In the first place up to the present time no attention whatever has been paid to the machanism ob the labium, and in the second place while some attention has been devoted to the homologies of Horace, the resuts appear to me incomplete and the supporting evidence insufficient.

Aside from the discussion by Gerstaecker of which a detailed account will be given in the proper place, we have only very few paragraphs embodied in papers on other subjects, by Rambur, Hagen, Brandt, and Comstock. The object of this paper is to present such new information as has been obtained and to supplement and in some cases correct the old.

The work has been carried on entirely in the labratory of Lake Forrest College and under the supervision of J.G. Needham, Ph. D. Prof. of Biology in that institution.

The material used was obtained entierly from his collection with the exception of some specimens loaned by the U.S. National Museum of Comparative Zoology and the Imperial Museum of Berlin which were at that time in his posession. The series of mounted adult labia which were studied, was prepared by me in specimens obtained from the above sources. With regard to the Ontogentic material, the eggs of Anx Junius were obtained when laid and developed in confinement. The embryonic stages studied were taken from eggs respectively seventeen and twenty days old. The embryonic stage of Lestes Umcata was obtained from some eggs collected by Prof. Needham, and the time which had elapsed since they were laid was uncertain.

The majority of the drawings were made by me directly from the specimens. A few however were made from photographic plates and some unpublished drawings by Prof. Needham.

THE MECHANISM OF THE LABIUM.

Every one who has devoted any attention whatsoever to the study of the odonata has been impressed by the enormously and curiously shaped Labium. This labium, which has been, not inaptly, compared to an asp, in the Libellulidae completely covers the remaining mouth parts and in the other families very nearly so. At first glance it seems unweildy.

in size and shape, but it is capable of remarkably swift and accurate movement. If one observe large nymphs of Anax Junius in proximity to which a few Ischmure nymphs have been placed it will be seen, that directly the former observed them, they remained perfectly quiet until the prey comes quite close to them, then with a motion so swift as to preclude the observation, the labium is darted out, the victim seized and instantly drawn up into a position in which the Mandibals can be used with advantage. The strenght of the labium is surprising, indeed when the animal is held suspended in the air by its extended tip, he can with ease lift a weight of his entire body up to the support.

The powerful muscles and hinges which constitite the machanism of the labium have never hither-to been investigated, these various movements are however secured by a comparatively very simple apparatus. For an understanding of the machanism of the labai, it would be necessary first of all to consider what are the various divisions composing the appendage.

The tipical labium consists of a sub-mentum and (sm.pl.1 Fig. 1.), amentum ~~and~~ (m. pl.1. Fig. 1), a ligula(li. Pl. 1 Fig. 1) which varies greatly in shape in the various families; two lateral lobes (ll. Pl. 1. Fig. 1) composed of a moveable hook (mh. Pl. 1 Fig. 1) and an end hook. these various parts are hinged together at four points, the moveable hooks are hinged onto the lateral lobes, the lateral lobes in their turn are hinged onto the mentum at ~~an-ei~~ the apical hinge, and there are hinges at the joining of the mentum and submentum, the middle hinge, and that at the juncture of the sub-mentum with the haad, or the basil hinge.

The moveable hook is without muscles,but four pairs of muscles are so arranged in connectinn with the hinges before mentioned, as to produce all the movements of which the labium is capable. These are a pair of abductors (a a Pl. 1 Figs. 1 & 2), a pair of abductors (b b Pl1 Figs 1 & 2.), a pair of extensors(d d. Pl 1 Figs. 1 & 2) and a pair of flexors (c c. Pl. 1 Figs. 1 & 2).The abductors, which are fastened to the external tendonous prolongation of the lateral lobe at its insertion into the mentum and which have their origin in the floor of the sub-mentum proximal to the middle hinge, served to throw the lateral lobe out as the labium is thrust out. The abductors which are inserted at the inner tendanous prolongation of the lateral lobe and which also originate in the floor of the sub-mentum at a point a little distal to the origin of the

abductors, serve to draw the lateral lobe down against the ligula. The extensors have their origin upon the forward prolongation of the hypo-pharynx and passing over the flexors and above the abductors near their origin, upon the hind ventral mentum below the hinge, These extensors by pulling over the basal hinge and the middle hinge obtain the leverage necessary to throw the entire labium out to its full lenght. The flexors, originating upon the tentorium, somewhat above the origin of the extensors, and inserting into the supero- lateral margin of the mentum distal to the hinge, by means of a tendon, fold the labium down into a position of rest.

Thus by the action of the abductor muscle in combination with the extensor and with the abductor with the flexor, the labium is thrust out the lateral lobes opened and the movable hooks mechanically extended, then when the victim is within touch, with the movement equally rapid and concerted, the lateral lobes are drawn down, the labium closes and the prey is held in a position in which it can most easily be devoured.

ONTOGENY OF THE LABIUM.

Lestes.-

Amazingly various as are the shapes of the labium more especially the shape of the lateral lobes, in the various families of Odonata, I thought it probable that greater simplicity of conditions might be discovered in the early nymplal and embryonic stages and that in this way some new light might be thrown upon the homologies of Horace. With this in view I studied a series of labia of Lestes uncata begining with the embryonic stage (Pl. 4, Fig 14), the stage at which the development is temporarily stoped when aestibation begins, (See account of the life history of Lestes by Prof. J.G. Needham in bul. 68 of the NY. State Museum pages 1903), and passing through a series of eight nymphaal stages up to a condition aproximating that of the full grown nymph (Pl. 2, Figs. 1-8).

In the drawing made from the embryonic labium (Pl. 4, Fig, 13) it will be observed that the development of the ligula is very imperfect in comparison with that of the lateral lobes showing two series of teeth with a lobe above the second series. This is probably the result of retarded development. The movable hook is already well developed and

separated from the remaining parts; the teeth are developed on the distal margin and to a less extent than the inner margin, the one at the end is already differentiated as end hook. In the earliest of the nymphal stages (Pl. 2, Fig.1), the lateral lobes are separated by a low broad ligula which has developed extraordinarily and which shows a trace of a cleft in the middle. On either side of this cleft are two teeth the precursors of those lobes which in the full grown nymph extend across the entire width of the mentum. The suture between the ligula and the mentum which in nymphs has hitherto been entirely overlooked, appears as a transverse line with a pair of minute teeth at its f point. The position of the teeth on the lateral lobe is much changed, owing perhaps to lateral expansion, the end hook is less evident but the development of the other teeth is about the same as in the previous stage.

In the next stage (Pl. 2, Fig. 2) after the second moult, a well developed seta is observed on the lateral lobe and the begining of one one the movable hook, one is also present on either side of the mentum, but this is not represented in the figure. The number of teeth on the inner edge of the lateral lobe has increased, while among those on the end, the one which latter forms the end hook is conspicuous by its size and is already divided from the others by a suture. The number of teeth on the ligula has increased and the cleft deepened, while a pronounced tooth has developed on the sutural line before mentioned.

In the third stage (Pl. 2, Fig. 3) the seta on the movable hook has attained its full development, the cleft between the end hook and the remaining teeth has become more marked, while the number of taeth on the ligula is still further increased and the edge og the ligula on either side of the cleff has become slightly elevated. After the fourth moult (Pl.2, Fig. 4) a differentiation is noticeable amoung the end teeth, the two at the extreme edges becoming slightly larger than the others and turning outwards away from them. Two setae make their appearance on the mentum. In the next stage (Pl. 2, Fig. 5) the principal change is in the gradual dissapearance of the sutural line, the rest of the development seems to be capitally stationary.

In the sixth of the series (Pl. 2 Fig. 6) a secon d seta makes

its appearance upon the movable hook, while the terminal teeth of the end group have become larger and are separated from the others by deeper cleffs. Three setae appear upon the mentum on either side. In the succeeding stage (Pl.2, Fig. 7) the separation between the terminal teeth of the end group and their companions has increased and their is an increase in the number of teeth on the border of the ligula. In the stage represented in plate two, Fig. eight, we find a condition very similar to that of the full grown nymphal labium. A third setae has developed on the movable hook and three are present on the mentum. The clefts between the end hook and the end teeth and the terminal teeth of the end group and the central ones have reached their maximum depth! The number of teeth on the inner edge of the lateral lobe and on the ligula has reached its maximum. The line beneath the border of the ligula has become a mere trace, the tooth which figured so prominently in the early stages being represented by a chitinized spot. The cleff in the ligula has reached its greatest depth. With the exception af a few additional setae upon the mentum this stage represents the full grown nymphal labium, no more changes take place until the transformation from nymph to adult.

Anax Junius.and Basiaeschna janata.

In the series of Anax junius contains two nymphal labia in different stages of development, and two embryonic labia. In the youngest embryonic labium (Pl.3, Fig. 1) the mentum is composed of two lobes separated by a deep cleft running almost to the sub-mentum. The ligula is as yet undeveloped. The movable hook is not as yet separated from the rest of the lateral lobe, in shape it strongly resembles the campus of the maxilla. In the succeeding stage (Pl. 3. Fig.2) we have a condition much further advanced and comparable to the embryonic labium og Lestes uncata (Pl. 4, Fig. 13). In this the hook like character of the movable hook has become distinct and teeth like have been developed along the end of the lateral lobe and two upon the inner edge. Teeth have developed in two series at the base of the cleft between the two divisions of the mentum and immediately above the lower series is a marked indentation whiah appears to be the beginning of a suture dividing each lobe of the beveloping ligula into two parts. The shifting

which these parts undergo in forming the ligula as it appears in the nymph will be discussed latter(page).

The earliest of the nymphal labia(Pl. 3. Fig. 3) shows comparatively little change in the lateral lobe. The number of teeth along the upper end of the lateral lobe has increased and two rudementary setae have appeared upon the lateral lobe just below the movable hook. These setae are exceedingly interesting from an historical standpoint as raptorial setae never appear upon the latter nymphal or upon the adult labia of Anax junius and were believed never to be present in the family. In contrast to the lateral lobe the ligula has developed enormously, having almost the appearance which it axhibits in a full grown nymph with the exception of a group of four teeth on either side of the cleft. The line beneath the border of theligula which was noted in Lestes uncata appears here also. In the next succeeding stage (Pl. 3, Fig. 4) we have a slightly latter stageof development. The diff rences are, however, slight consisting in the appearance of a number of teeth on the inner edge on the end hook and of the second group upon the border of the ligula.

The development of the labium of Basiaeschna janata is along much the same lines as that of Anax. In the condition shown in (Pl. 3, Fig. 5) we have a state strictly comparable to that shown in (Fig. 3) of the same plate. In this figure one of the teeth upon the end is already slightly separated from the others and has become longer. It is this tooth which remains as the end hook while the others disappear. In the latter stage (Pl. 3, Fig 6) teeth have appeared upon the inner edge onof the lateral lobe and hairs are developed along the edge of the ligula. In the stage shown in (Pl.3 Fig. 7) the only difference is in the decrease in size of the teeth on the end of the lateral lobe and on either side of the cleft in the ligula, and in the almost complete closure of that cleft. In the last stage (Pl. 3, Figl 8) the end hook has become more hook like. The one tooth has become a hook itself and the others are represented only as chitiniz-ed spots. The teeth on the inner edge of the lateral lobe have increased in number, while those on either side of the cleft in the ligula have dissappeared being represented

only by a band of chitin. The hair along the border of the ligula, which in the early stages were small have increased in size and covered the entire border up to the cleft. The cleft is represented only by a slight depression and by a line extending down upon the surface of the mentum to about its original depth.

Libellulidae.

In contrast with Basiaeschna in which the development tends toward the disappearance of the teeth on both lateral lobe and ligula, we have the representatives of the Libellulibae, namely Epicordulia princeps, Tetragonuria cynosura, and Libellula pulchella, in which the tendancy throughout the nymphal life is to increase in complexity in both lateral lobe and ligula. In the new hatched Epicordulia (Pl. 1, Fig. 4) the ligula is comparatively simple. The center is marked by a slight depression between two slight elevations, whileon either side is inserted a small spinule. Beneath these is a line, probably the indication of a former suture, and beneath that six setagerous punctures. The second stage (Pl. 1 Fig. 5) shows a number of teeth along the border of the ligula, while the two spinules have increased considerably in size and four smaller ones have developed one above and below the before mentioned ane on either of the center od of the ligula. In the final stage(Pl. 1. Fig. 6) the border of the ligula has become still more complicated the number of teeth has increased and below and in the notches bet ween each pair of teeth is a spinule. These diminish in size from the center to the edges of the ligula. The six sepagerous punctures have entirely disappeared.

The new hatched ligula of Tetragonuria (Pl. 1 Fig. 7) shows al almost exactly the same condition as the early stage of Epicordulia. The two spinules and the sixth irregularly placed setagerous punctures are present but the teeth between the setae zre three in number and are not uniform in sixe. Libellula pulchalla shows the six setagerous punctures placed some distance below the border of the mentum, but the spinules are absent and the border presents not distinctly defined teeth but instead in the exact center are four small

irregular elevations. The lateral lobes of Libellula and of Epicordulia are almost identical.

The new hathhed Gomphus spicatus (Pl.1 Fig. 3) is worthy of notuce especially with regard to the development of the teeth on the lateral lobe. Instead of having teeth on the upper end as in Labellula and Epicordulia or on the inner edge as in Basiaeschna, they are placed all around the edge, giwing an intermediate condition,infrom which the development might very easily go in either direction, No end hook is differtiated. The ligula shows four teeth in the center with a spinule on either side and finally a tooth on the outside of eace spinule. The line immediately inder the border of the ligula which showed so plainly in Epicordulia is less plainly marked.

HOMOLOGIES OF PARTS.

The most important paper upon the paper upon the homologies of the parts of the labium, which has appeared up to this time, is"Zur Morphologie der Orthopera Amphibotica" von A.Gerstaecker. In this Gerstaecher advances the thenry that the ligula of the labium is formed by the fusion of the two laciniaw and that each lateral lobe consists of the fused calpus and galea. In support of this theory of the homologies of the parts of the labia and of the maxilla he offers the following evidence; the similarity in appearance, in the imago, of he movable hook of the lateral lobe and of the terminal joint of the calpus, the separation of the lateral lobe into two parts by a longitudinous suture and the different inclination of the surfaces of the two parts.

Thas assertion appeared to me to be based upon very insufficient evidence especially in view of the fact that the suture which he mentinns of dividing the lateral lobe into two parts seems to be entirely absent in such labia as have been examined in the course of this study. A wide furrow is present but with careful observetion o no suture could be detected. In another particular Gerstaechers contention appears to me illogical, for while he very truly contends that it is probable that the missing joint in maxilla and labium is fused with one of the others, in the maxilla he believes the lacinae and galaae to be fused together, while in the labium he very inconsistantly declares that calpus and galeae are fused together to form tha lateral lobe, while

the ligula and mentum represnet nearly the two lacinae.

In the course of my examination of adult labia I noticed a fact which seems hitherto to have been overlooked, namely, the presence in certain Agrionidae of a distinct suture which starting from the base of the cleft of the ligula runs transversly to within a short distance of its border, and then turning runs paralell with the border down to the mentum (Pl. 6. Fig. 6) The transverse portion of this line is bordered with hairs and at the side nearest the cleft from the ligula it is produced into a point similar to that of the border of the ligula. In Platycnemis acutipennis (Pl. 6. Fig. B) we have a simalar condition withe the exception of the hairs within the suture, upon the lower part of the mentum.

The presence of this distinctly defined suture upon the mentum gave rise to the opinion, which, without much supporting evidence is advanced by Rambur and Hagen, that the mentum was formed by the consolidation of two pairs of the appendages of the maxilla, the lacinae and galeae, and that the lateral lobe repersented the palpus alone. An examination of the labia of several species in the embryonis stage comfirm to this opinion. In the embryonic labium of Lestes uncata (Pl. 4, Fig. 13) it will be observed that the teeth in the cleft between the two divisions of the developing mentum are forming in two sets. The lower series, consisting of three teeth increasing in size from the bottom upward are already w quite storgly chitinized and appear to be separated from the others by a short diatance. In the empryonic labium of Anax junius (Pl. 3, Fig. 2) this separation is marked by a deep indentation, evidentaly the beginning odof a cleft which latter will divide each lobe into two.

Now this theory asumes that the lower sets of teeth represents the tooth lborders of the lacinae and the upper those of the galaea while the lateral lobe represents the palpus much modified in shape and complicated by its change in function. In the development of the ligula the lacinae consolidate and the lobes representing the galeae grow together above them, inclosing them on all sides accepting at their juncture with the mentum. This theory gains for us from the fact that in many of the Orthoptera and Plecoptera

a condition exists analogous to this of the embryonic stage. Notably in Diapheromera and Prisopus we find the laminae externa slipping up over the lacinae in such a manner as to partially surround much as is the case in the embryonia labia of Anax. It will further be observed that the lateral lobe articulates witht a segment quite separate from that with the ligula articulate, and that this piece seems in every way to correspond to the palpiger. From this evidence it seems reasonable to conclude that, in the so called lateral lobe of the labium of the Odonata, we have represented merely the pappalpus of the typical maxilla, while the ligula and mentum represent the consolidated lacinae and galeae

COMPARATIVE ANATOMY OF NYMPHAL AND ADULT LABIA BY GROUPS.

The forms of the labia are exceedingly variable in the various families of the Odonata, both during the nymphal life anf later after transformation. Thr variations in a single group are however comparatively slight and each group can be adaquately represented by a single typical speciman together with several of those showing the most marked differences,

Adult labia

Libellulidae.

In the labia of adult Libellulidae average witdth of the mentum and ligula is 1.87 times its lenght, while the ligula exhibits a rounded point without a cleft. The lateral lobes are uniform in shape, the proportion of length to width being 1:1, they are deeply concave. The end of the lateral lobe is rounded and covered with hairs externally, and the movable hook is a very small and sharply pointed rudiment. Micrathyria berence (Pl.6, Fig. 3) is typical of the adult Libellulid labium. In this group the chief variations are in the movable hook and in the dispotion of the hai rs on the lateral lobe. In Synthenis crebistyla (Pl.6 Fig. 3 D) the movable hook is represented by a chitinized spot while the hairs are sparse and are placed all around the border of the lateral lobe. Much the same condition exists in Didymops transversa (Pl.6. Fig. 3 B) but the hairs appear on the surface of the lateral lobe and there is a marked depression in the border of the lobe directed behind the chitinized spot forming a small lobe in front of the movable hook. Cordulia shurtleffi (Pl. 6 Fig.3 A.) has the hook wider and blunter, with the hairs very abundant. Psuedo phlebia minima (Fig. 6 Fig. 3C) is deeply chitinized along the inner border of

the lateral lobe, and the hook is short and sharp. It differs from Micrathyria however in the absence of hairs on the surface of the lateral lobe. This group is much more specialized than any of the others and is difficult of comparison as the changes, especially in the lateral lobe, and almost obliterated the hooks.

Aeschninae.

The Aeschninae present charistics widly different from those just emntioned. Thr width of the mentum and ligula is usually 125 times its length, and the cleft though ordinarily absent is always indicated either by a slight depression in thecenter of the ligula or by the arrangement of the hairs along its border. Sometimes, however, a short but distinct apicl cleft is present. The movable hook is well developed; a short fleshy, and usually blunt and upon the lateral lobes on either side of it is developed a more or less well defined hook. Both lateral lobes and ligula are covered with numerous hairs. A very good representative of the group is Gynacantha trifidia (Pl.6 Fig. 4). In Coryphaeschna ingens (Pl.6. Fig. 4 A) the movable hook is iunuasually large in the end hook is large and deterred. The ligula (Pl.6 Fig. 4 B) shows a slight elevation in the middle of its border with a short cleft in the center. In Aeschmophleeia anisoptera (pl. 6 Fig. 4 C) the end hook is large and clearly defined but the lobe beside it is comparatively small. The lateral lobes a of Aeschna constricta (Pl.6 Fig. 4 D) differs little from those of Gynacantha but the ligula (Pl. 6, Fig. 4 E) shows a more marked depression. Basiaeschna (Pl.6. Fig. 4 F) shows the inner hook very strongly developed while the lobe is almost absent.

Gomphinae.

The Gomphinae, belonging to the same family as the Aeschninae, have many points of similarity with them. The mentum and ligula is one and 1.4 times as wide as it is long and ithe cleft in the ligula is always absent. The lateral lobe is about 1.35 times as long as wide, and the movable hook is large and well developed. The end hook is well developed and of the outer lobe there is onlu occasionally a trace. Oppiogomphis Carolus(Pl. 6, Fig. 5) show these characteristics as well as any species. A profusion of hairs covers the entire labium, mentum, lateral lobes and all. In Gomphus bulgatissimus (Pl.6, Fif. 5 A) the

movable hook is long and pointed and the end hook also is of unusual length. The upper lobe is a mere protuberance on the border of the lateral lobe. The greatest development attained by the movable hook, however, is shown in Aphylla edntata (Pl.6 Fig. 5 B), in which the movable hook is wonderfully long and slim,while the end hook almost equals it in length. The upper lobe has entirely disappeared.

Cordulegaster and Tachopteryx.

Cordulegaster maculata and Tachopteryx thoyeri are the sole representatives of theire respective sub families which I have studied. Cordulegaster (Pl.6, Fig.1) shows a mentum cleft to about one fourth its length. The cleft is wide and V-shaped and on either point a small tooth is developed. The surface and border of the mentum are covered with hairs. The lateral lobe is also thickly covered with hairs, the movable hook is short and blunt, while the end hook is long and sharp, and has a series of four small hooks developed along its inner edge. (Pl.6, Fig. 1 A). It will be remembered that the end hook of Calopteryx angustipellis (Pl.6, Fig. 6 E) ehibited one hook on its inner margin. These hooks, it seems to me, may not improbably be a development carried over from a nymphal condition. Tachopteryx (Pl.6, Fig 2) shows a ligula very similar to that of Cordule gaster. The mentum as well as the lateral lobe is thickly covered with hairs. The movable hook is large but blunt and the end hook is short, slender,and incurved.

Agrionidae.

In the Agrinidae the proportion of the width of the mentum to its length is as 1:1, and the cleft in the mentum is always present. It varies in depth from .75 to .20 of the entire length and prpportionately large. The existance of a suture across the ligula has already been mentioned, and this suture as well as the external body of the ligula is covered with hairs. The movable hook is a medium size and blunt, then end hook is very lagre often larger than the end hook, while the outer lobe has quite disappeared. Both the movable [illegible] the rest of the lateral lobe are covered with hairs. Euphea masoni (Pl. 6 Fig.6) is a good type of the family. In the lateral lobe of Platycnemis acutipennis (Pl. 6, Fig. 6 A) the development of the movable hook is proportionately greater and both that and the end hook are both strongly incurved.

The mentum and ligula (Pl. 6 Fig. 6 B) differ a little from those of Euphea. In Paleophlebia superstes (Pl.6 Fig. 6 C& D)the movable hook is largely developed, while the end hook is small and not very hook like in character. A slightly different type of end hook is shown in (Pl. 6 Fig. 6 E), a small hook has developed upon its inner edge. In Calopteryx maculatus (Pl.6 Fig. 6 F.) the end hook is divided from the rest of the lateral lobe by a distinct suture. This suture is probably of secondadary nature in importance. Besides these labia which have been figured I have also examined the labia of the following:

Calopteryx maculatus Selys
Heteraeina americana Fabr.
Sympetrum correptum Hagen
Plathemis lydia Drury
Rhyothemis splendida Rambur
Framea lacerata Hagen
Mesothemis simplicicollis Say
Micrathyria Bberenice Drury
Nannothemis bella Uhler
Perithemis domitia Drury
Synthemis brevistyla Selys
Hemicordulia tan Selys
Tetragonuria spinigera Selys
Cordulia shurtleffi Scudder
Macromia illinoiensis Walsh
Orthemis ferruginea Fabr.
Didymops transversa Say
Brachidiplax indica Kirby
Brachythemis contaminata Fabr.
Palpotleura sexmaculata Fabr.
Diastatops tincta Rambur
Pseudophledia minima Kirby
Onychothemis abnormis Brower
Zygonyx iris Selys
Gomphoides stigmatus Say
Mecistogaster SP.(?)

Arbhilestes grandis Selys
Ophiogomphus carolus Needham
Progomphus obscurus Rambur
Gomphus exilis Hagen
Hemigomphus ochraceus Selys
Epigomphus paludosus Selys
Gymacantha trifidia Ramber
Basiaeschna janata Say
Gomphibia confluens Selys
Aeschnophlebia anisoptera Selys
Aeschna clepsydra Say
Aphylla edentata Selys
Epiaeschna heros Fabr.
Staurophlebia magnifica Brauer
Coryphaeschna ingens Rambur
Aeschna constricta Say
Hagenius brevistylus Selys
Corbule gaster maculatus Selys
Tachopteryx thoreyi Selys
Nephepeltia phyrne Perty
Hemicnemis bilineata Selys
Pyrrhosoma nymphula Sulzer
Platycnemis acutipennis Selys
Nesolestes alboterminata Selys
Telebasis allandi Martin
Xanthagrion erythroneurum Selys

Protoneura capillaris	Rambur	Euphea masoni	Selys
Diphlebia lestoides	Selys	Mnais strigata	Selys
Synlestes weyersi	Selys	Heteragrion flaboditttatum	Selys
Argiolestes ictéromelas	Selys	Hetaerina americana	Fabr.
Disparoneura vittata	Selys	Paleophlebia suprestes	Selys
Calopteryx angustipennis	Walker	Cora inca	Selys
Ceratura capreola	Hagen	Thore picta	Rambur
Naurobasis chinensis	Linne		

It will be observed, that with the exception of the Libellulidae, in which the parts of the lateral lobe are almost unrecognizable, these labia are very similar. The chief differences are in the presence or absense of the cleft in the ligula and in its size and shape when present, in the shape and size of the movable hook and of the two hook on either side of it, and in the presence or absence of the hairs on the whole labium. The general contours are very similar and the same parts are present in all the groups.

Nymphal labia.

In the consideration of the nymphal labia of the various groups it would be well to observe the same sequence which was observed in treating of the adult labia. The Libellulidae will therefore first engage our attention.

Libellulidae.

In this family the nymphal labia are upon the whole somewhat more complicated than the adult labia. The mentum has much the same appearance and the ligula is, as a rule, smoothly rounded as in the adult, but the lateral lobe is quite dissimilar. Periphemis donitia(Pl. 5, Fig. 5) ieis typical of the group. The lateral lobes are toothed along the ends and near the outer edge appears a row of fine setae terminated by a strong spine. Two groups of nine setae each appear midway down the mentum. The lateral lobe of Tetragoneuria cynosura (Pl.5 Fig. 5 H) is very similar witht the exception of the fact that in each of the teeth are inserted three small spinules, debreasing in size b from the bottom upwards. The border of the ligula (Pl.5 Fig. 5 F) is thickly covered with hairs, and is flatter than that of Perithemis. Phyllomacromia Sp. (?) (Pl.5 Fig. 5 D) shows the teeth more strongly developed, the two uppermost ones have become sharply pointed, while

the spinules inserted in the three lower have increased in number to five. The lateral lobe of Mesothemis simplicicollis (Pl.5, Fig. 5 C) resembles Tetragonuria, although the number osof setae is greater. The ligula is like that of Perithemis in shape but is heavily boardered with hairs (Pl 5 Fig. 5 A). Epopthalmia elegans is very different from the others of the group. The lateral lobe (Pl. 5 Fig. 5 C) is bordered with long, sharp, strongly incurved teeth, six in number, and the setae are entirely absent; while the ligula (Pl. 5 Fig. 5B) has a deep cleft in the center, with a rounded protuberance on either side. The ligula of Orthetrum cancellatum (Pl. 5 Fig. 5 E) exhibits another variation from the typical ligula, a slight elevation marks the center, while on either side are a number of small teeth with a small spinule between each pair.

Aeschninae.

The typical Aesbhninae labium is well represented by Basiaeschna janata (Pl. 5, Fig 2) . The ligula shows a shallow cleft and its borders are thickly covered awith hairs. The lateral lobes have a strong sharply pointed mavable hook, while the end hook, although short, is stout and sharp. The inner edge of the lateral lobe bears a number of small chitinized spots, the witnesses of the existance of teeth in that position earlier in the nymphal life. Aeschna constricta (Pl. 5 Fig. 2 A) shows a different type of end hook, blunt, and straight across the end, with a small hook at the inner edge. In the lateral lobe of Staurophlebia magnifica (Pl. 5 , Fig. 2 B) no traces of teeth are visible on the inner edge, and the end hook is short but strongly incurved. The ligula of this speciman (Pl 5, Fig. 2 C) has one very Peculiar feature, on either side of the central cleft is developed a long but very slender tooth. The border beyond the teeth is covered with hair. The ligula of Boyera is characterized by a very small tooth on either side of the central cleft and at some distance from it. The border, on both sides of the teeth, is covered with hairs.

Gomphinae.

The Gomphinae labia differ comparatively little from those of Aeschninae. In the typical speciman , Gomphus vulgatissimus (Pl.5 Fig, 1), the lateral lobes are perhaps larger in proportion to the