

Observations on certain *N. A. NEUROPTERA*, by H. HAGEN, M. D., of Königsberg, Prussia; translated from the original French MS., and published by permission of the author, with notes and descriptions of about twenty new *N. A. species of PSEUDONEUROPTERA*.

BY BENJ. D. WALSH, M. A.

[N. B. In September 1862, I published in the Proceedings of the Philadelphia Academy of Sciences, a paper on the Pseudoneuroptera of Illinois, (pp. 361-402), describing over forty species which I supposed to be new. Shortly afterwards I forwarded duplicates of most of these species to Dr. Hagen. The following Article from his pen was received by me in April, 1863; and it is most gratifying to find that his views in most cases coincide with mine. The new species now described by me, were all found within four miles of Rock Island, Illinois, with the exception of *Heterina texana* received from Texas through Mr. Uhler. None of my specimens are alcoholic—B. D. W.]

PSOCINA.—PSOCUS.

†† *Tarsi 2-articulate. Discoidal cellule closed, quadrangular.*

PS. PURUS Walsh. New to me. One ♀.

PS. SEMISTRIATUS Walsh. One ♂, three ♀. Allied to *Ps. quietus* Hagen. Is it different? *Ps. quietus* is described from a ♀ in bad condition, from the State of New York (Coll. Winthem), and another ♂ from Georgia. The latter seems to me identical with *semistriatus*, the former is possibly different—the wings are partly deficient, the pterostigma entirely. The specimen from New York has the "black spots on the nasus." The description of *Ps. quietus* must apparently be revised, or possibly entirely erased. [See note 1.]

PS. PERPLEXUS Walsh. A specimen, apparently identical, was received by me from Mr. Walsh, in 1860.

PS. LICHENATUS Uhler (auctore ipso). New to me ♂ ♀. A cabinet name of Mr. Uhler's. [See note 2.]

†† *Tarsi 2-articulate. Discoidal cellule open, absent.*

PS. GEOLOGUS Walsh. Very like *Ps. salicis* Fitch, of which I possess only a single specimen, possibly a little immature. The neurulation is exactly similar. *Ps. geologus* is deeper colored, of a brown approaching to blackish; the antennæ are a little more robust and the wings a little longer. It remains to prove whether *Ps. salicis* is an immature ♀ and *Ps. geologus* a ♂ of one and the same species. It is a difficult

question to decide with dried specimens gummed on paper. Finally it remains to be proved, whether both are not identical with *Ps. pedicularius* Linn.=*Ps. domesticus* Burm. They are certainly closely allied. Mr. Walsh has correctly remarked to me that on page 13 of my Synopsis the pterostigma of *Ps. salicis* should be said to be "posteriorly," or rather apically truncated, instead of "anteriorly." [See note 3.]

Ps. CORRUPTUS Hagen. The specimen sent me by Mr. Walsh seems in reality to belong to this species, but its wings are more deeply colored and the hyaline apical spot is subobsolete, while it is very visible in the five individuals in my collection. Mr. Walsh writes me word that "*Ps. corruptus* is not the other sex of *Ps. abruptus*," (as I have suggested in the Synopsis,) "because the latter is very common, and the former very rare." But this is well known to be the case in some European species. You may find thousands of ♀♀ of *Ps. bipunctatus* together, and not a single ♂. It is the same thing with *Ps. variegatus*, and especially, as it seems, with those species that live in some sort of society, while with the others, e. g., *Ps. lineatus*, the two sexes are common. I have seen 12 specimens of *Ps. abruptus* all ♀, and 6 of *Ps. corruptus* all ♂. Finally, I have received in the same package and from the same places, (Washington, Dalton, Pennsylvania mountains,) the two species together. I agree with Mr. Walsh, (p. 362,) that the neuration of *Ps. abruptus* may be reduced to the normal type of *Psocus*, but there are aberrations which I shall take occasion to explain at some future period, to justify the language used by me in the Synopsis. [See note 4.]

PERLINA.

In this difficult family my materials are now very rich, received from the Arctic and Subarctic regions and from Baron Osten Sacken, &c.; but they require a careful revision, which I hope to give them during the coming summer. For the present I may say that *Acroneuria rupinsulensis* Walsh is distinct from the *Acr. abnormis* received from Mr. Walsh, and this last differs from the species referred by me to *abnormis*, a specimen of which has been sent to me by Mr. Uhler as coming from Illinois. [See note 5.] The genus *Pteronarcys* requires an entire revision, and for that end I noted in London the form of the genital organs. Mr. Walsh is perfectly right in saying (p. 365) that

the "postcostal space" is different and opposed to the "postcubital space." He views the subject exactly as I do.

EPHEMERINA.

Mr. Walsh's method of breeding the Imago from the Subimago in this family, is the only correct way to arrive at a more perfect knowledge of it, and I have endeavored myself to do the same thing here. But as in each species the ♂ and ♀ imago are often very different, and the ♂ and ♀ subimago different again, and as lastly living Ephemerina are too different from the dried specimens to be able to determine them from descriptions taken from dried specimens, we ought to have for each species EIGHT DESCRIPTIONS! Some considerable work yet to be done, before we can arrive at a correct knowledge of this family!

BÆTIS.

B. FEMORATA Walsh. I am not convinced that this is Say's species. *1st.* The ♂ ought to have "the caudal setæ hardly twice the length of the body," or about 25 mill. (one inch), while the ♂ subimago (Walsh) possesses setæ only as long as the abdomen. Again, the ♀ of Say's species ought to have the setæ nearly as long as the ♂. *2nd.* Say says, "thighs banded with reddish brown near the middle and at tip," so there are *two bands*, which are not met with in Mr. Walsh's species. *3rd.* Says says, "wings snowy white;" we cannot say that in *B. femorata* Walsh, the wings are of that color.

In Mr. Walsh's description it is said, "abdomen with joints 1—5 whitish;" but joint 1 is piceous, and it is 2—6 which are whitish. He is right in remarking, that I erred in abridging Say's language. After all, we may possibly agree with him, that the description of the legs is correct, for it corresponds with the legs of the ♂ Imago; but it seems to me that the length of the setæ is opposed to his opinion. This beautiful species is new to me. [*See note 6.*]

B. ALTERNATA Say, (Walsh.) This species is new to me and is very probably the species of Say. The individuals mentioned by me (*Syn.* p. 49) are different—the venter fuscous, &c.

Walsh *Pseudoneur.* p. 368 Bætis § A. and p. 370 Bætis § B, "First tarsal joint *large*, always *larger*," &c., is apparently an error, for "*long*" and "*longer*." [*See note 7.*]

B. ARIDA Say (Walsh.) There is nothing in Say's brief description which opposes the identity of *B. arida* Walsh and Say. The words "anterior tibiæ whitish obscure at base and tip," were a little suspected by me, but I see that in reality the ♂ (Walsh) has the tibiæ a little pale. Two ♂♂ received from Mr. Walsh in 1860, one of which is much smaller than the other, have the tibiæ altogether black. [See note 8.] The "orbit" is, according to Say's Glossary, "an imaginary border around the eye." "Vertex with a small black spot each side on the orbit," agrees very well with the ♀, but the tibiæ of the ♀ are all black. I cannot find the ♀ from Washington (cited Syn. p. 46), but after a careful revision of my other Ephemerina, I find I have not received this species except from Mr. Walsh.

B. SICCA Walsh. A good species. "Abdomen piceous above except the last segment;" I can see no different color, or even different shade of color, in the last segment. [See note 9.] It seems to me that the base of the first joint of the anterior tarsi is black. [See note 10.] I have received a ♂ of this species from Washington, and in 1860 I also received from Mr. Walsh, along with a small specimen of the ♂ ♀ imago, a ♂ subimago, which probably belongs to this species. The character of the [anterior] legs being short in the ♂ is a good one, and so is that of the brown incisures of the setæ; but in any case it seems to me that a more precise comparative description, with indications of differences, would still be desirable. [See note 11.] The ♂ from Washington, for example, is partly intermediate between *arida* and *sicca*, for the setæ have only some dark incisures at their base. In ♂♂ of the genus *Bætis*, sometimes the form of the penis is a very good and easily seen character, but I cannot get to see this organ in these two species. Possibly it can be more easily done in the living specimens. After all, I am convinced that these are two different species.

B. DEBILIS Walsh. I only know the pair received from Mr. Walsh. The diagnosis of Walker is too brief, but it contains nothing contradictory. The ♂ has the penis bifid, black, the two bifurcations straight and parallel, a little tapering towards the tip. This character is very easily seen, because the color of the apical parts of the abdomen is altogether pale.

B. ALBA Say. There is an Article by Dr Williamson, "on the

Ephoron leukon, usually called the White Fly of the Passaik River," in the Trans. Amer. Phil. Soc., (Philadelphia, 1802, Tom. V., No. VII. p. 71—4.) I extracted in London the following description:—"Eyes large and prominent; ocelli none; wings membranous, reticulate; hind wings one-half shorter, narrower, and covered by the front wings; antennæ setaceous, half an inch long, [apparently the anterior legs are meant, *Hagen*,] six-jointed and with a basal joint; two anal appendages $1\frac{1}{2}$ inch long, divergent, with from 15—20 joints; tip of the ♂ abdomen with two elbowed claws, $\frac{1}{10}$ inch long, curved inwards. Length of the insect $\frac{1}{2}$ inch; body not thicker than a grain of rye; abdomen narrower. Wings, abdomen and legs white, eyes black, body fuscous, flight like that of a *Libellula*. They appear about 15 minutes after sundown. The chrysalis is like the imago; the chrysalis appears and immediately afterwards the imago appears. The ♀ lays two eggs. They are as numerous as snow-flakes. Passaik River, N. J., Belville Bridge, 2 miles, for 3 weeks after the 20th of July."

I think this is the *B. alba* Say, *Hagen*, of which I have only seen a subimago in very bad condition from the Red River of the North. As Dr. Williamson's data are very precise, one might easily verify the species upon the spot. [See note 12.]

The genus *Bætis* is a difficult one. *B. obesa*, *fusca*, *debilis*, *arida*, *ignava*, *fuscata*, *invaria*, *annulata*, *femorata*, *luridipennis*, *basalis*, and *noveboracana*, I have described only from the short descriptions of Say, Walker, &c. Of the seven others, *B. tessellata*, a poor alcoholic specimen, is possibly not a *Bætis*, and for the six remaining species my materials were very slight when I wrote the Synopsis. I have received since some very fine Ephemerina from Baron Osten Sacken. *B. vicaria* is different from any species described by Mr. Walsh.

POTAMANTHUS.

P. ODONATUS Walsh, (= *P. nebulosus* Walker.) ♂ imago, Saskatchewan, R. Kennicott, 1860. Head, antennæ and thorax above and beneath black, highly polished. Abdomen piceous above with paler incisures, brown beneath, the incisures paler; anal processes brown; penis bifid, apex divaricating; the two exterior setæ very robust, brown, the incisures darker; the middle seta fine, white, the incisures fuscous, alternately wide and narrow on the basal half, uniform behind the middle and towards the tip becoming very wide. Anterior legs pice-

ous; four hind legs brown. Wings hyaline, the terminal third of the anterior wings brown abruptly, the extreme border of the tip hyaline; cross-veins hyaline, fuscous on the apical third; costal veins yellowish, the apical stigmatal part darker. Five ♂.

Subimago ♂. Very similar to the imago, but differs as follows:—the general color is the same, but not polished; setæ shorter, without incisures, pilose, the middle one piceous and stouter than in the imago. Anterior wings similar to the imago, but the hyaline part dull or sublurid; posterior wings pale yellowish, the apical third grayish brown. One ♂.

Imago, length ♂ 9—11 mill. Expanse ♂ 18—22 mill. Exterior seta ♂ about 22 mill. Interm. seta ♂ about 10 mill. Ant. leg ♂ about 10 mill.

Subimago, length ♂ 9 mill. Expanse ♂ 19 mill. Interm. seta ♂ about 8 mill. Ant. leg ♂ about 7 mill.

The coloration of the wings in this species is almost like that of *P. marginatus* Zetterst., a very common species with us. On comparing my description of the specimens from Saskatchewan, I believe that they are identical with *Potamanthus* (palingenia) *nebulosus* Walker. In 1861 I noted in London that the wings of *nebulosus* are brown on their apical one-third, so that Mr. Walker's description agrees very well. I think *P. odonatus* Walsh, is also identical with this species from Saskatchewan. The character "with a definite outline" = the extreme tip hyaline. [See note 13.]

P. CUPIDUS Say, Walsh. (= *Potamanthus* [palingenia] *concinus* Walker.) I have compared the 2 ♂ 1 ♀ imagos from Washington, (April,) described by me as *P. concinns*, and they agree very well with Mr. Walsh's description of *P. cupidus* ♂ imago, except that they are a trifle bigger; but a third ♂ imago received from Washington has exactly the same dimensions. I have also received two ♀ subimagos from Washington and Maryland, which are apparently *P. concinns*. Specimens of the subimago ♂ ♀ sent me by Mr. Walsh differ from Say's description in the [4 posterior] tarsi not being black. [See note 14.] I have also received from Mr. R. Kennicott from Saskatchewan 2 ♂ 1 ♀ subimago of *Pot. cupidus*. As the species is said by Say to be common at Cincinnati about May 15th, it would be easy to verify it.

I received from Mr. R. Kennicott in 1860, from Saskatchewan, 6 ♀

imagos, which differ from the ♂ imago of *nebulosus* Walker, (= *odonatus* Walsh,) described above as coming from Saskatchewan, in the head and prothorax being marked with yellowish, the anterior legs brown, the exterior setæ white with larger black incisures on their basal half, and the wings hyaline. The ovarian valve is pale, oval, deeply excised and bifid on the apical half. Length ♀ 9 mill. Expanse ♀ 25—28 mill. Ext. seta ♀ 15 mill; intermed. seta ♀ 8 mill. Ant. leg ♀ 7 mill. It is difficult to determine whether this ♀ belongs to *P. odonatus* or to *P. cupidus*, for, as before stated, I received ♂ ♂ of both these species from the same locality. [See note 15.]

It will thus be seen that I reduce the four described N. A. species of *Potamanthus* to two. After all, it is possible that they may be different; but with the materials before me and the published descriptions, it is impossible to be sure of the fact.

It is remarkable that the American species of *Potamanthus* constitute a special group, from the fact of the intermediate seta being much slenderer and shorter than the exterior seta, while in the *Potamanthus* of Europe they are equally robust and equally long.

PALINGENIA.

In Ephemerina there is no doubt that many new genera will have to be established. *Cænis*, *Oligoneuria*, and *Ephmera*, are good genera, and the few known species resemble one another. But *Potamanthus*, *Palingenia*, *Bætis* and *Cloe* will have to be separated, and M. Pictet himself has perceived that these genera are composed of very different types. *Palingenia*, for example, ought to be separated as follows:—

1. PALINGENIA. Wings large, opaque, with numerous cross-veins. Two very long setæ ♂ or short and hairy ♀; the intermediate seta very rudimentary. Anterior legs ♂ more robust, of moderate length, with the femora equal in length to the tibiæ; the other legs feeble, short and in a rudimentary state; the first joint of the tarsi free in the anterior legs alone. The ♀ remains in the subimago state and does not moult. Eyes ♂ almost contiguous. Ancient type—*P. longicauda* Swammerd. *P. fuliginosa* Boch. (Black Sea.) *P. lata* Walker (Silhet.) *P. atrostoma* Weber (Brazil.) *P. dorsalis* Burm.? (Brazil; I am only acquainted with ♀.)

2. DIFFERT. Eyes widely separated. Intermediate seta ♀ as long as the others, hairy at the tip. Anterior legs ♂ slender, very long,

with the tibiæ much longer than the femora; the other legs feeble but long. The ♀ remains in the subimago state?—*P. virgo*. *P. puella*. *P. alba*. *P. albifilans* (Para.) *P. umbrata* (Amazon.) *P. latipennis* Walker, (Para.)

3. DIFFERT. Intermediate seta ♂ (Is it so in ♀?) very long; I am unacquainted with the exterior setæ. Anterior legs feeble, long, and with the tibia longer than the femur. Eyes ♂ almost contiguous.—*P. spec. nov.* (Rio Janeiro.) An *P. Hecuba* Hagen?

4. DIFFERT. Eyes ♂ widely separated. Setæ long; intermediate seta ♂ ♀ very rudimentary. Legs equally robust and long; anterior legs ♂ scarcely longer, with their femora and tibiæ equal in length.—*P. dorsigera* Hagen, (Buenos Ayres.) Two new species from Mexico.

5, 6, 7. Mr. Walsh's groups A B and C. In the groups 1—3 the membrane of the wings is more delicate, being always folded up in the dead specimen.

The 7th group, Mr. Walsh's subgenus C, is most widely separated from the rest, and is apparently a well defined genus. We must retain for the first group the name of *Palingenia*. The second group is doubtless a very good genus. As to the 4th group we may perhaps unite it with the 6th, Mr. Walsh's subgenus B. The 5th group I do not know.

My revision of the N. A. Ephemerina in the Synopsis is not as complete as I could wish, for it was impossible for me accurately to re-examine the Ephemerina of the British Museum in 1861, because I had not my own types with me as in 1857. *P. viridescens* Walker, is probably *P. bilineata* Say, Walsh, subim. ♀, but larger (exp. 51 mill.) and of the color of my ♀ subimago from Ohio, referred to below.—*P. occulta* Walker is probably *P. bilineata* Say, imago.—*P. bicolor* is a ♀ subimago of the same group, perhaps of *P. limbata* Pictet.

Of groups 5 and 6 the species are—

1. *P. VITTIGERA* Walsh. I do not know this species, which is apparently a very interesting one. [See note 16.]

2. *P. BILINEATA* Say, Walsh. (*P. limbata* Hagen.)—*P. limbata* Guérin, Ramb. ♀ imago. (Rambur's description is word for word that of Guérin.)—*Bætis angulata* Walker, ♂ imago.—*P. viridescens* Walker. ♀ subimago.—♂ imago (very large, length 18 mill. Exp. 38 mill. Seta 60! mill. Ant. leg 16 mill.) ♂ ♂ subimago and ♀ subimago

from Rock Island.—♂ ♂ ♂ imago, ♀ imago and ♀ subimago from Chicago.—♂ imago from Red River of the North.—♂ imago North Am.—♀ imago from St. Louis.—♀ subimago from Ohio (paler.)

Besides the above, I have an abnormal ♂ from Rock Island, which, after a careful examination, I believe to be a variety of this same species. Length 20 mill. Exp. 30 mill. Seta 32 mill. Ant. leg 10½ mill, (femur 3 mill, tib. 3¼, tarsus 4 mill.) It resembles the ♂ of *P. limbata* Walsh, but is of a deeper color, the yellow less bright, the brown stripes wider and of a deeper color; the front legs with the femur, tibia, the first joint of the tarsi, the tip of the three following, and the whole of the last, as well as the claws, black; the four hind legs of a bright yellow with only the last tarsal joint and its claws black. Wings hyaline, marginal band of the front wings of a deep brown, the hind wings not bordered with brown; all the veins and cross veins blackish, except at the base; some cross veins in the basal portion of the front wings not far from the costa, and some in the middle of the hind wings, bordered with black. Setæ pale brown, the incisures scarcely marked, with the base of a few of the joints yellow beneath; intermediate seta present but indistinct.

It now remains to compare this abnormal ♂ with *P. bilineata* Say, Walsh. I have before me, besides the ♂ from Rock Island mentioned above, of which the dimensions are so great, 5 ♂. Three from Chicago are very much alike. Length 18—20 mill. Exp. 38 mill. Seta 45 mill. Wings a little fumose, hind wings with the exterior border blackish. Ant. leg 14 mill; hind legs yellow, the tip of tarsal joints 2—4, black beneath or not black. Setæ brown with the basal half of the joints yellow. Body of a deep color. Abdomen long, with two yellowish or fulvous spots on each joint. One ♂ from Red River of the North, (determined as *bilineata* Say, by Mr. Uhler,) resembles the three from Chicago, but the band at the tip of the hind wings is subobsolete. Finally, a ♂ without any precise habitat, with the band of the hind wings altogether absent. I remark that the relative proportion of the tarsal joints is far from being constant; for I see that 3 is sometimes as long as 2, sometimes shorter, and even one-half shorter (♂ Uhler.) The ♂ from Rock Island is large, its setæ and legs are longer and its wings more fumose. [See note 17.]

It seems to me that the shortness of the front legs, in common with

the shorter setæ and the considerably longer abdomen, are remarkable characters. It is true that we sometimes find Ephemeroine imagoes with the legs shorter than common, and that they are animals which sometimes have their legs damaged in the larval state and replaced by shorter ones; but then the two anterior legs are not ordinarily of exactly equal length as they are here.

3. *P. LIMBATA* Pictet, Walsh. (*P. bilineata* Hagen.) The identity with Pictet's species remains to be proved; it may be altogether new.—♂ ♂ ♀ ♀ imagoes, ♀ subimago Rock Island, 1860.—♂ ♂ imagoes Washington.—♀ imago St. Louis.—Length ♂ ♂ imagoes from Rock Island, 16 mill. Exp. 29—32 mill. Seta 39 mill. Ant. leg 12 mill. They agree with the ♂ ♂ from Washington (cited p. 41 of Synopsis), but they are a little smaller. The description of these ♂ ♂ must be corrected, because the abdomen shows on the dorsum of each segment a median black band which does not attain the base except in the three penultimate segments, and may even be altogether absent in the anterior segments (♂ from Washington.) Finally, in place of "anterior feet fuscous, basal articles of the tarsi yellow," read "articles of the tarsi yellow at the base." The words "penis apex incurved, oval," must be erased, for I do not find that it differs from that of the other species. The brown margin of the hind wings is very narrow and may even be altogether absent.

4. *P. SPEC. NOV.* An *P. vittigera* Walsh ♀?—♀ imago Rock Island; ♀ subimago Philadelphia.—♂ imago [*P. vittigera* Walsh? B. D. W.]—The ♀ imago from Rock Island differs from the two described ♀ imagoes of *P. limbata* as follows:—1st. The size is larger; length 25 mill. Exp. 52 mill. Setæ broken. 2nd. The prothorax is visibly longer, less wide near the thorax. 3rd. Segments 3—6 of the abdomen have more brown, the [brown] bands joined at the tip, so as to form only two basal oval [fulvous] spots. 4th. The 4 hind legs have only the last joint of the tarsi as well as the claws brown. 5th. The wings are hyaline. 6th. The intermediate seta is a little longer (2 mill.)—Is it *P. limbata* Pictet, Walsh? or the ♀ of *P. vittigera* Walsh? The ♀ subimago from Philadelphia (Coll. Winthem, mentioned Synopsis p. 41,) has the same dimensions and apparently belongs here. The colors are more obscure; on the abdomen there is only a wide brown dorsal band; the wings are yellowish gray, and the legs are as in the imago.

It remains to compare this ♀ imago from Rock Island with *P. bilineata* Say, Walsh (*limbata* Hagen.)—♀ Imago from Chicago, expanse 44 mill. Seta 30 mill.; Ant. leg 11 mill.; abdomen in bad condition.—♀ Imago from St. Louis in alcohol has the dimensions given in the Synopsis. [Length 29 mill. Exp. 46 mill. Seta 20 mill.]—On comparing the ♀ from Rock Island with these two, it seems to differ in its larger size, in its general color being yellow, very like that of ♀ *limbata* Walsh (*bilineata* Hagen,) in its hind wings being without bands, and in the color of the feet and of the setæ. [See note 18.]

P. FLAVESCENS Walsh, ♂ ♀ imago. New to me. A good species. Easy to separate from similar *Bætis* by the relative proportions of the basal joints. Joint 1 is shorter than 2; 2=3; 4=1.

P. INTERPUNCTATA Say, Walsh. *P. PULCHELLA* Walsh, and *P. TERMINATA* Walsh, I have not yet found time to examine. It seems to me that the ♂ ♂ from Maryland, referred to in the Synopsis under *Bætis verticis* Say, are *P. pulchella*, and the ♂ ♂ from Washington *P. terminata*. [See note 19.]

EPHEMERA.

E. NATATA Walk. Cat. I now possess ♂ ♀ imago and subimago from Saskatchewan.

E. DECORA Hagen, differs in reality from *E. decora* Hagen, Walsh, by the characters mentioned, and is rather yellow than luteous. The ♀ described by me is exactly like the ♂ and is from Chicago, the habitat of Mr. Walsh's species. It is possible his species may be *E. simulans* Walker Cat., but the dimensions are a little too small and rather those of *E. hebes*.

E. NOV. SPEC. I have received from New York ♀ imago of a new species. It is very large, (length 19 mill. Exp. 42 mill.) the wings hyaline and much spotted, the abdomen very bright yellow immaculate. It resembles somewhat *E. danica* of Europe.

E. PUDICA Hagen, is probably no Ephemera but a *Bætis*. Joints 1—3 of the tarsi in all the feet are long and equal, 4 a little shorter. 5 equal. I am vexed that I did not entirely omit this solitary specimen of a ♀ subimago with the head and the tip of the abdomen both gone.

E. FLAVEOLA Walsh. A very good and interesting species, received by me from Mr. Walsh in 1860. [See note 20.]

EPHEMERELLA Walsh.

E. EXORUCIANS Walsh. New to me. I must study the genus further. Are the eyes really simple? [Beyond all doubt. B. D. W.] I suspect that some *Potamanthus*, Pictet, (a genus which comprehends very different species,) must in that case enter *Ephemerella*. *Leptophlebia* Westwood, is *Potamanthus*.

BÆTISCA Walsh.

B. OBESA Say, Walsh. Both genus and species new to me; very curious.

CLOE.

C. VICINA Hagen, Walsh. A new species with four wings, but probably *C. posticata* Say. *C. vicina* Hagen, has only two wings and the colors are paler, a reddish brown. I have received from Mr. Uhler, from Maryland, a ♂ imago of a *Cloe* n. sp. very like *C. vicina*, but it has four wings. [See note 21.]

C. UNICOLOR Hagen, Walsh. It is the species described by me, which has four wings. I only know 3 ♀ from Washington and 1 ♂ from Pennsylvania.

C. DUBIA Walsh. A new species. In *C. vicina* the thorax is a pale fulvous, and the tip of the abdomen deep brown, immaculate.

C. MENDAX Walsh. A new species.

C. FLUCTUANS Walsh. Very like *C. undata* Pictet, of which I possess 2 ♀ from New York and Red River of the North (Kennicott) with their setæ annulated with brown. The two species cannot be identical, for the number of cross-veins and their arrangement is very different. Otherwise the abdomen of the ♀ is spotted in a very similar manner with little dark dots. The two ♀ of *C. undata* have very numerous cross-veins, like *C. ferruginea* Walsh, the abdomen "freckled" in the same manner. They resemble *C. fluctuans*, but are a little larger, besides having some brown clouds on the hyaline part of their wings. The setæ have brown incisures; but in one specimen of *undata* Walsh, (the other one has no setæ) the basal incisures are brown.

C. PYGMÆA Hagen. I only possess one ♀ imago in bad condition.

It is the smallest Ephemerinous species known. It belongs to Mr. Walsh's section B "four wings, cross-veins sparse."

CÆNIS.

C. HILARIS Say=AMICA Hagen. I do not possess this species. It is in the Berlin Museum; and I have no other remarks to make on it than those in my description.—I received in 1860, from the upper Wisconsin River, through Mr. Uhler, a new species *C. nigra* mihi.

ODONATA.

SYNOPSIS p. 65, 4th line from bottom, for "two antecubital transverse nervules," read "Pterostigma regular."

IBID. Line 2 from bottom, "the 4th apical sector broken." This 4th sector is a very constant vein in all Odonata, and separates from the "principal sector" between the "nodal" and the pterostigma. M. Selys names it now the "ultranodal sector." M. Charpentier was the first to observe that the 4th sector is broken in *Lestes*, and after him authors have always employed this character. As the Synopsis of *Lestes* and *Podagrion* appeared last year, I note here what there is in it relating to North America.

LESTES ALACER: We have received the ♀.—*L. STULTA* is very probably *L. forcipata*.—*L. VIDUA* (and *L. minuscula* Uhler) are *L. congener*.—*L. TENUATA*: we have the ♀. In the Synopsis of N. A. Neur. dele p. 69, last line, "similar to *L. forficula*."—*L. HAMATA* (No. 12) is the true *L. forcipata* of Rambur; so M. Selys has named No. 13 (my *L. forcipata*) *L. hamata*.—Finally, we have described two new species, *L. DISJUNCTA* Me., Ill., Nova Scotia, Red River, Saskatchewan, &c., and *L. VIGILAX* New Jersey, Uhler, a species received before from the Vienna Museum. I am not yet sure but it is synonymous with *L. inæqualis* Walsh; at all events it must be closely allied, especially the abdominal appendages.—*Lestes Eurina* Say, Walsh, I do not know. [See note 22.]—There are altogether in our Synopsis 50 species of *Lestes*. In the Synopsis of *Podagrion* there is nothing new in reference to North America.

I have read with much interest Mr. Walsh's exposition, p. 381—8. It is a veritable progress, and I entirely approve of his ideas. In general M. Selys and myself have used Rambur's nomenclature, with

the intention of giving a general resumé on all the parts, after we have finished our work. Then it will probably be necessary to make much change, so as to establish a correct, natural, and philosophic nomenclature. [See note 23.]

Mr. Walsh's new *Gomphus* and his descriptions are superb. * * * It is the scourge of science, and especially of Entomology, that we have always plenty of dilettantes and but very few with real knowledge, based upon regular and truly philosophical study. [See note 24.]

SIALINA.

SIALIS INFUMATA Newm. Rightly determined by Mr. Walsh. I have it from many places, especially from Saskatchewan. It is very desirable that the anal appendages should be figured and described from the living specimen. The species of this genus are not easy to separate, and I am not sure that *infumata* is not synonymous with *fuliginosa*, a European species; but on the whole they are probably different. [See note 25.]

CHAULIODES SERRICORNIS and *MACULATUS*. There is a confusion in the Synopsis, as I was only acquainted with the ♀ of *serricornis* and the ♂ of *maculatus*. I now possess ♂ ♀ of both. On comparing Say's description, I find that *C. serricornis* Say, is the true *C. maculatus*, and that *C. serricornis* Hag. Synopsis is a new species. I was partly led into the error in consequence of receiving a ♀ from Mr. Uhler, labelled *C. serricornis* Say. I now view the species as follows:—

CHAULIODES LUNATUS Hagen.= *C. serricornis* Hag. Synop. It is the ♀ that is described in the Synopsis, but instead of the words "marked with black," (p. 191, line 1,) read "bordered with black"; and instead of "with white spots," (line 4,) and "veins spotted, white," (line 7,) read "bordered with white." The words "bordered with black" (*nigrocinctis*) in my work are not altogether correct, for the veins are only bordered with a more obscure color. In the more highly colored ♂ ♂ the veins are scarcely bordered, for then the black color is uniform. The ♂ has foliated antennæ, each joint with a large oval plate underneath, a structure which Say could never have described as "deeply serrated." The head and thorax are more slender and highly colored than in ♀; the design of the wings is the same. It may be remarked that the words "a larger anal spot white" in the

Synopsis, should be corrected, for there is "a large rounded *basal* white spot," which is wider than the band of the wings. This spot is easily seen, and is the easiest character by which to distinguish the species. The inferior appendage ♂ is elongate, narrower at tip, and of a pale brown color.—♂ ♀ New York: ♂ Maryland and Illinois (from Mr. Uhler.) ♀ Pennsylvania. Length of front wing ♂ 24—28 mill ♀ 34 mill. [See note 26.]

CHAULIODES SERRICORNIS Say = *Ch. maculatus* Hag. Synopsis. The ♂ has serrate antennæ, and the inferior appendage is of a shining black at tip, and less elongated and wider than in the preceding. Both ♂ and ♀ have the base of their wings black.—♂ Savannah (type) Burm. — ♂ North America.—♀ New York (June), Connecticut.—A ♂ from Mr. Uhler, labelled Maryland and Illinois, has the band of the front wings a little wider and the apical spots of the hind wings almost united into a large, irregular, oval spot. Two ♂ from Massachusetts (Uhler) and New York (June) are a little smaller and more highly colored. A very highly colored and large ♂ (labelled Maryland and Ill., June 8. Uhler) has the band on the front wings wider. It has foliate antennæ like *C. lunatus* but cemented on with gum and as it seems erroneously.—Length front wing ♂ 21—26 mill. I may add that *Ch. fuscatus* Walker (Australia) seemed to me identical with *Ch. serricornis* Say. Possibly Walker's habitat is erroneous.

CHAULIODES RASTRICORNIS, Ramb. ♂ ♀ received from Mr. Walsh, a superb pair. I had before received a ♀ from Illinois (Uhler); the ♂ I did not previously know. *Ch. pectinicornis* ♀ differs in having pectinate antennæ. I am very curious to see the larva of Chauliodes. [See note 27.]

CORYDALIS CORNUTUS, Linn. The larva possesses both branchiæ and spiracles, like that of *Sialis*. I do not think that the [lateral] filamentous appendages are connected with respiration; the little sponges at the base of the filaments and a little behind them are the true branchiæ. It is a very curious, and up to this day a unique fact, that the larva of an *Odonate* from Ceylon (*Euphæa splendens*) possesses similar filaments. The reason that the larva of *Corydalis* has both branchiæ and spiracles is, that they live, like *Sialis*, some weeks out of the water before their transformation. Some extraordinary MS. statements from Mr. Walsh, as to these larvæ "tumbling down chim-

neys," ought to be published in detail. The larva of *Sialis* never travels far from the water. [See note 28.]

HEMEROBINA.

MANTISPA BRUNNEA Say. Mr. Uhler's note on this species is probably an error. (Synopsis. p. 208.) The facts stated by him should be verified. It is *contra leges naturæ* that an organ should be abused in that manner. [See note 29.]

HERMANN HAGEN.

KÖNIGSBERG, PRUSSIA,
April 3, 1863.

NOTES BY BENJ. D. WALSH.

N. B.—There is great confusion in the description of the parts of the wing by different authors, arising from the fact that some consider the wing as expanded at right angles to the body, and some as closed. Hence in different authors the terms "anterior" and "posterior" are used in entirely different senses, some, as Dr. Fitch for example, considering the basal portion of the wing as the "anterior" portion, and others, including I think the great majority, considering the costa as the "anterior" portion. In all my published descriptions I have endeavored, as far as possible, to avoid this ambiguity by using the terms "basal," "costal," "terminal," and "interior," instead of "anterior" and "posterior"; but wherever I have, for one reason or other, retained these latter terms, I wish to be understood as speaking of the *expanded* wing.

PSOCINA.—PSOCUS.

Note 1, p. 167. *Ps. QUIETUS* Hagen. I failed to identify my species with *quietus*, because the diagnosis in the Synopsis says, "Thorax black, wing-veins luteous," whereas *semistriatus* has the thorax black with the sutures conspicuously whitish, and the wing-veins black, or more properly speaking, perhaps, *fuscous*.

Note 2, p. 167. As this species has never been described, I annex the following description of it, as well as of another species which I have met with since the publication of my Paper on Pseudoneuroptera. Both of them belong to this section of *Psocus*.

Ps. lichenatus, n. sp.—Brown. *Head* with the *nasus* often pale yellowish brown; antennæ shorter than the wings, with the basal half of each joint whitish except towards their tip, those of ♂ more robust and with long and dense cinereous hairs, those of ♀ more slender and but slightly hairy. *Thorax* generally paler on the sutures. *Legs* pale yellowish brown, the tibiæ and especially the femora dotted with brown. *Front wings* brown, with a long triangular hyaline spot, its apex next the costa, extending from the disk to the interior margin, another at the costal apex, and a third on the terminal margin, the two last leaving a brown parallelogram between them one-third as wide as the wing. Veins the color of the wing, marked on the brown portion, except towards the base, with a row of pale dots placed on one side of them. Pterostigma brown, three times as long as wide, its widest part $\frac{2}{3}$ of the way to its tip, with a dark dot at its basal end, and the angle next the disk regularly rounded. Hind wings, as well as their veins, subhyaline. Length to tip of wings 3—3½ millimetres.

Five ♂, seven ♀. Occurred in the autumn, on some precipitous sandstone cliffs, in great numbers.

Ps. bifasciatus, n. sp.?

Differs from *quietus* Hagen, (= *semistriatus* Walsh,) in the veins being coarser and blacker, in the pterostigma being cinereous with a large irregular black spot at the interior angle which is rounded, in the vein closing the discoidal cell being white not black or fuscous, in the existence of a faint white spot at the origin of the branch of the 1st sector, (or first discal bifurcation,) and in there being always two distinct narrow nebulous fasciæ on the basal half of the front wing. The size is also one-fourth larger. Length to tip of wing 5 mill.; alar expanse 9 mill. Three ♀.—In the whiteness of the vein closing the discoidal cell, and in the white spot on the 1st sector, this species agrees with *Ps. novæ-scotiæ*, which however is much larger, and has the interior angle of the pterostigma very acute and the wings spotted on their terminal half. Traces of the white markings of the wing-veins occur in some specimens of *semistriatus*, and I am not certain that this is not a mere variety of that species. The fasciæ are the only strongly marked character that divides them. From confounding a single specimen with *semistriatus*, the dimensions I have assigned to that species are one millimetre too great. *Ps. striatus* Hagen, differs in the pterostigma being "acute," (by which I understand that the interior, or as it is often called, the "posterior" angle is acute.) and in other respects.

Ps. PERPLEXUS Walsh. I have now two additional specimens, taken

in company, in one of which the discal bifurcation of the front wing is peduncled, in the other it is not. The same variation has been described as occurring in *semistriatus* Walsh. Both specimens, in addition to the described fuscous spot at the point where the anal vein strikes the interior margin of the wing, have a very small faint fuscous cloud on and in front of the anal vein $\frac{1}{2}$ of the distance from its base, and also another between the forks of the discal bifurcation, traces of which last may be seen in my original specimen. The pterostigma is almost black, instead of pale fuscous, or cinereous. These clouds might seem to approximate *perplexus* to *Novæ-Scotiæ*, but in *Novæ-Scotiæ* the veins on the posterior side of the discoidal cellule and at the origin of the branch of the 1st sector are milk-white; in *perplexus* they are fuscous.

PS. POLLUTUS Walsh. A specimen taken at Rock Island has the coloration of the vertex and thorax more obscure. The dimensions are the same.

Note 3, p. 168. PS. GEOLOGUS Walsh. In the autumn of 1862 I beat a specimen of *Ps. amabilis* Walsh, off an oak tree remote from any house, the first specimen having been found dead amongst my insects. If *Ps. geologus* be identical with *Ps. salicis*, and if, as the name indicates, this latter species was found on willows, it is most probable that both *amabilis* and *salicis* are indigenous insects, and that the latter is not identical with the European *Ps. pedicularius* Linn. I commonly, however, find the European *Dermestes lardarius* near Rock Island, under bark, remote from houses, along with its larva, feeding apparently on the dead insects and spiders which accumulate there. I believe that both *amabilis* and *geologus* are, in the imago state, normally apterous but occasionally winged, and that it is these species which infest collections of insects in which camphor is not kept. In a close box good camphor kills them in half a day. They are so peculiarly fond of Ephemerina that I find it necessary to dry all my Ephemerina in a close box with camphor in it.

Note 4, p. 168. PS. ABRUPTUS and PS. CORRUPTUS Hagen. So far as I can judge by their eyes and antennæ, all my 9 specimens of *abruptus* are ♀, and all my 9 specimens of *corruptus* ♂. The facts indicate that Dr. Hagen was right in supposing the two species to be identical. The hyaline apical spot is very plain in all my specimens of *corruptus*, but varies much in size.

The following species belonging to this section of *Psocus* have been obtained by me near Rock Island since my paper was published :

Ps. conterminus, n. sp.—Blackish. *Head* with the *nasus* obscure greenish or luteous. Sutures of *thoracic* notum but slightly pale. *Legs* dull pale greenish or luteous; *tarsi* fuscous. *Wings* hyaline, veins moderately fine, fuscous; the submedian vein attaining the 2nd sector within about the space of twice its own breadth, so as almost to close the discoidal cellule, and then turning suddenly back so as to form a posterior marginal cellule nearly in the shape of an equilateral triangle. Pterostigma three times as long as wide, very pale fuscous, sometimes darker at the basal end, the angle next the disk much rounded off. Length to tip of wings $4\frac{1}{2}$ mill.

One mature ♂, one immature ♀? Very distinct from any described N. A. species. Has the general appearance of *semistriatus* Walsh. which belongs to the preceding Section, but the antennæ ♂ are much more robust and the neuration of course is different.

Ps. confuens, n. sp.—Dull luteous. *Head* with the eyes and ocelli brown-black; antennæ, with joints 1 and 2 luteous, 3 fuscous, the rest deficient. Upper surface of *thorax*, except the sutures, brown-black. *Legs* with the knees and the tips of the *tarsi* obfuscated. *Wings* narrow, brownish subhyaline, veins very coarse and brown; pterostigma colored as the wing, long and narrow, about 4 times as long as wide, the angle next the disk almost entirely rounded off; the submedian vein not nearly attaining the hind margin of the wing before it curves towards the 2nd sector (or 2nd discal bifurcation) and sweeps back to the interior margin to form the posterior marginal cellule, which is consequently open at its basal end, and forms a semicircle. Discal bifurcation acute but peduncled. Length to tip of wings 3 mill. Expanse $5\frac{1}{2}$ mill.

One specimen, remarkable for the two sectors in the left wing uniting together some distance before they reach the tip, a monstrosity which I have not noticed in any other species. Differs from *Ps. mobilis* Hagen, a Cuban species, in not being hairy.

Ps. rufus, n. sp.—Rufous, immaculate. *Head* with the antennæ fuscous, except the three basal joints. *Abdomen* with the sutures a little darker. *Tarsi* obfuscated. *Wings* hyaline; veins slender, black; pterostigma three times as long as wide, with the angle next the disk rounded, slightly obfuscated, with the usual black dot at its basal end; submedian vein attaining the hind margin of the wing before it curves round to form the posterior marginal cellule, which is semicircular. Length to tip of wings $3\frac{1}{4}$ mill.

One specimen, readily distinguished from the preceding by its neuration, and by the much finer wing-veins, the shorter pterostigma and the wings not narrower than usual.

Ps. permadidus, n. sp.—Dull luteous. *Head* with a large black spot on the ocelli and two dark dots placed transversely on the occiput; antennæ pilose, fuscous except the three basal joints, which are pale. Lateral lobe (or scutum)

of the *thorax* black; anterior lobe (or *præscutum*) dull luteous. *Wings* of a uniform grayish subhyaline color; veins fine, dusky; pterostigma grayish subhyaline, long, three times as long as wide, with the angle next the disk almost entirely rounded off; discoidal bifurcation peduncled; submedian vein stopping when it attains the interior margin of the wing and forming no posterior marginal cellule. Length to tip of wings $3\frac{1}{2}$ mill.

One specimen ♂?—Near *madidus* Hagen, but differs in the *nasus* being immaculate, in the antennæ being fuscous except at base, and in the wings being immaculate and their veins fuscous not luteous. May possibly be a variety of that species, but in *Psocus* the coloration of the wings is a very constant character.

Ps. madesceus, n. sp.

Differs from the above only as follows:—*1st.* The size is $\frac{1}{2}$ smaller. *2nd.* The dark dots on the occiput are obsolete in two specimens and subobsolete in the other one. *3rd.* The front wings, but not the hind wings, are fumose with about 10 or 12 hyaline spots and streaks always between and not on the veins, each cellule, except the pterostigma, containing one or two of them so as to occupy altogether about $\frac{1}{2}$ the wing, different specimens varying a little in the distribution of these spots. *4th.* The wing-veins are much coarser.—Length to tip of wing $2\frac{1}{2}$ — $2\frac{3}{4}$ mill. Three specimens, all ♂? Differs from *madidus* Hagen, in the *nasus* being immaculate, the antennæ fuscous except at base, the wing-veins fuscous, not luteous, and the hyaline spots and streaks presenting no appearance of two bands. It cannot be a mere sexual variety of the preceding, for the eyes and antennæ are similar.

PERLINA.

Note 5, p. 168.—*ACRONEURIA ABNORMIS* Newm., Walsh, and ACR. *RUPINSULENSIS* Walsh. I have now before me 7 ♂ 4 ♀ of the former and 2 ♂ 3 ♀ of the latter species, the ♂ of which was previously unknown to me. In *abnormis* the antepenultimate ♀ ventral is scarcely longer than the preceding segment, and its tip is scarcely at all produced or curved, not covering more than $\frac{1}{2}$ of the penultimate ventral, and there is no vestige on it of any subterminal tubercle. In *rupinsulensis* the antepenultimate ♀ ventral is full half as long again as the preceding segment, and its tip is much produced, somewhat in the form of a rectangle truncate at tip, so as to cover full $\frac{1}{2}$ of the penultimate ventral, and there is a distinct transverse linear tubercle upon it $\frac{2}{3}$ of the distance from its base. This seems to be the only

perfectly constant character to separate the two species. In both the shape of the prothorax is variable, and not as sharply contrasted one with the other as in the typical specimens, though there is a separating limit which neither transgresses. In one ♂ and one ♀ *abnormis* the sides of the prothorax are exactly parallel, in the others a little convergent behind, as described. Again, in the same ♂ *abnormis* the dorsal line of the prothorax is as dark as any part of it; in all the others ♂ ♀ it is as pale as any part of it; in all 5 *rupinsulensis* ♂ ♀ the dorsal line of the prothorax is as dark as any part of it. I can perceive no ♂ character separating the two species, the ♂ ♂ of both having the same glabrous, transversely oval, subterminal tubercle on the eighth or what is apparently the last ventral joint, except that in the anomalous ♂ *abnormis* already twice referred to, this tubercle is smaller. Consequently ♂ *rupinsulensis* can only be distinguished from ♂ *abnormis* by the comparatively greater breadth of the prothorax and its approximating more or less to the cordate form. In *abnormis* the number of subterminal cross-veins in the front wing, exclusive of the "arc," is 2—12, and in *rupinsulensis* 1—11, there being sometimes in the former a difference of 4, and in the latter a difference of 1 cross-vein between the right and left wing. The dimensions, judging from the eye, are the same.

All my specimens of *abnormis* agree pretty closely with the diagnosis in the Synopsis, with the variations noted above. Dr. Hagen does not say in what respect my *abnormis* differs from the specimen received from Illinois and referred by him to *abnormis*, and it is useless therefore to speculate on the subject. Judging from the long list of synonyms in the Synopsis, either several species are there confounded together, or it must be a more polymorphic species even than I have found it to be.

Chloroperla fumipennis (= *Perla fumipennis* Walsh.) ♂ Shining brown-black. *Head* bright or obscure luteous, with a large, round, shining, black spot enclosing the ocelli, which are only two in number. *Antennae* luteous on their basal 4. *Thorax* scarcely wider than long, its sides straight and a little convergent behind, its anterior angles rounded and its posterior angles much rounded. *Abdominal* seta luteous on its basal 4. *Legs* dull luteous, widely or narrowly vittate above with fuscous on the femora and tibiae; tarsi fuscous. All four wings equally tinged with fuscous, the front wing with a hyaline streak on the discal side of the origin of the accessory subcostal vein, and another between the postmedian and postcostal veins, and with their costa dull luteous; postcostal cross-veins 1—4; veins in all four wings fuscous. Alar expanse 15½—17 mill.

Two ♂ taken on Rock River, in addition to the one ♂ which I wrongly described as a *Perla*; ♀ unknown. But for the difference in the number of the ocelli, this species might be taken for a variety of *C. brunipennis* Walsh. I do not know whether any other N. A. *Chloroperla* has only two ocelli. *C. bilineata* Say, and *nana* Walsh, I know to have three, and *severa* Hagen, is expressly described as having three. As nothing is said as to their number in the other 5 described species, we may presume that they also have three. It is remarkable that in *Perlina* the number of ocelli, which elsewhere is of high systematic value, becomes scarcely of subgeneric value. Since, however, the species of *Perla* are very numerous, it affords a convenient means of subdividing that difficult, polymorphic and extensive genus.

NEMOURA ALBIDIPENNIS, Walker. This species, of which I have taken 5 specimens, may now be added to the list of Illinois *Perlina*. It is easily known from *N. completa* by its wing-veins margined with fuscous, and the absence of the two pale fuscous fasciæ from the front wings. The latter occurs on the Mississippi River, the former in the neighborhood of Rock River.

EPHEMERINA.—BÆTIS.

Note 6, p. 169.—*BÆTIS FEMORATA* Say, described by Say in the subimago only.—Say describes, in all, ten species of *Ephemerina*, at least one of which (*B. obsa*), and most probably one or two others, are subimagos. Yet he nowhere drops a word from which it can be inferred that he knew the difference between the imago and subimago states, or that there was such a state as that of subimago.* It is pos-

* All subimagos known to me may be distinguished from their imagos by the wings being ciliate except on the costa. Sometimes this ciliation can scarcely be seen except under the lens, or by holding the wing up to the light. Their abdominal setæ are likewise always more or less pilose, but this character is found also in the imagos of *Bætis* ♀ A (Walsh) and *Palingenia* ♀ B (Walsh), towards the tip of the seta. On the subimago or pseudimago state see Westw. *Introd.* II, pp. 27—28 and *Note 2*. Westwood here infers analogically that a subimaginal pellicle "is to be found in the bee as well as the beetle." It has been actually observed in the Ant by Huber, (quoted in St. Fargeau *Hymenopt.* I, p. 114,) and I have myself recorded it as found on the antennæ of a Chalcidæ species, *Glyphe viridescens* Walsh, (*Trans. Ill. State Agr. Soc.* IV, p. 390,) and have since observed the same thing in several other Chalcidians.

sible, therefore, that in describing this species he had specimens of the subimago before him with the setæ, as often happens, badly shrivelled up, and described the ♂ setæ as "hardly twice the length of the body" (20—24 mill.) from recollection of the ♂ imago, which he might have seen but not had before him at the moment, and which has setæ of that exact length. The setæ of the ♂ ♀ subimago, when perfect and not shrivelled up in drying, are, as I have stated, as long as the whole body, (10—14 mill.) and not merely "as long as the abdomen," as Dr. Hagen states from the dried specimen. It is remarkable that in Say's description of *Potamanthus cupidus*, (another species described by him in subimago,) the setæ of the ♂ (called by him by mistake the ♀) are not only given as less than one-half their natural length, but that they are given as less than one-half of what they are said to be in the body of the description itself, viz: "longer than the body," and less than one-half as long as those of the ♀ (= ♂ apud Say); whereas in *Ephemerina* the exterior ♂ setæ are never shorter than those of ♀. It is possible, however, that the word "four-twentieths," in Say, may here be a clerical or typographical error for "nine-twentieths," which would make his description harmonize both with nature and with itself. Yet the doubtful word is printed at full length and not in figures.—In regard to the *second* objection of Dr. Hagen, four specimens of the subimago, which I have still on hand, all exhibit a very narrow terminal brown annulus, on the extreme tip of the femur, besides the broad postmedian band; in the imago, as stated by Dr. Hagen, this annulus is very distinct, though I carelessly overlooked it in my description. Instead of saying "base of tibiæ brown," I ought to have said "knees brown."—In regard to the *third* objection, viz: the wings not being "snowy white," as stated by Say in his description, it is observable that in the diagnosis prefixed to the description, the wings are said to be "whitish," and this is the color attributed to the wings of *Palingenia bilineata* by Say, ("hyaline, whitish,")—an insect which in the subimago has wings colored exactly like those of *B. femorata* Walsh, subimago, but which in the imago has the wings rather "sub-hyaline" than "whitish." Similarly in *Bætis alternata* the wings are said by Say to be "whitish," or "hyaline with a whitish reflection," whereas in the imago they are perfectly hyaline and in the subimago of the usual gray, subfumose, or "whitish" tint, as Say would call it. In all these cases Say appears to me to have confounded imago and

subimago together, and endeavored to comprehend both in one description, if I have correctly identified Say's species.

On the whole, if *B. femorata* Walsh, is not identical with *B. femorata* Say, what other known species is identical? Dr. Hagen knows of none, and I know of none. There are some slight discrepancies, it is true, in Say's description, but we are often compelled to overlook these, when no other species can be found to which the original description better applies. For example, in Coleoptera, *Elater sanguinipennis* is described by Say as having the "elytra striate," not "punctate-striate," as they are in the species now referred by common consent to *sanguinipennis*. On the other hand, in *Elater* (corymbites) *hieroglyphicus* the elytra are said by Say to be "striated, the striæ with very distinct punctures and the interstitial spaces punctured;" whereas in the species now generally referred to *hieroglyphicus* Say, the elytra are not strictly speaking punctate-striate, but the striæ are merely irregularly encroached upon by the fine punctures of the interstitial spaces. Nobody but those who have tried it can be aware how difficult a task it is to draw up perfectly faultless descriptions. Say's descriptions are generally admirable, so far as they go, but even Say has committed some errors. It may be added that Say's species is said to have occurred at Cincinnati, Ohio, "not in any considerable numbers," and that my species occurs quite sparsely at Rock Island, Illinois. If the two should eventually prove not to be identical, I would propose for mine the name of *B. interlineata*, in allusion to the remarkable black line on the middle of the costa which occurs also in *Palingenia interpunctata* Say.

In regard to Dr. Hagen's remark, that in the imago of this species abdominal joint 1 is piceous, and that it is 2—6 which are whitish, not 1—5, as I have described them, I can only state briefly that, in my opinion, what Dr. Hagen considers as the 1st abdominal joint is in reality the metathoracic postscutellum. At all events, besides this disputed joint, there exists in the abdomen of all Ephemerina the typical number of 9 joints, all bearing spiracles except the last, which cannot therefore be considered as a mere anal plate, because then the last abdominal joint would bear spiracles, which, so far as I know, is never the case with any insect in any one of its states. Similarly, I believe that in Odonata what Messrs. Selys and Hagen and preceding neuropte-

rists call the 1st abdominal joint is the metathoracic postscutellum, and their abdominal joints 2—10 the true abdominal joints 1—9; although, to prevent confusion, I have adopted the customary phraseology in my descriptions. In Ephemera, on the contrary, the abdomen is usually described as 9-jointed both in larva and imago. (Westw. *Introd.* II, pp. 26 and 31.)

The same mistake has been made by authors in certain entire Orders, e. g., Coleoptera, and in certain families of other Orders, and has been corrected by Westwood in Tenthredinidæ and Tipulidæ. I had originally intended to accompany this Paper by a general Enquiry, illustrated by drawings, into the Homologies of the Segmental Subsegments, for which I had prepared copious materials; but the subject has extended to so much greater length than I had anticipated, that I reserve this Enquiry for a future occasion.

Note 7, p. 169. This is an error, for which nobody but myself is to blame. In English "large" refers both to *length* and *breadth*, and it is *length only* which is here spoken of. Singularly enough, in French "large" refers to *breadth only* and in Latin "largus" refers *neither to length nor to breadth*, meaning simply "abundant."

Note 8, p. 170. B. ARIDA Say, Walsh. I have noticed this variation in the coloring of the anterior legs in my description. The anterior tibia ♂ ♀ varies from pale greenish, slightly obfuscated at base and tip, to dark fuscous or brown-black, immaculate.

Note 9, p. 170. B. SICCA Walsh. A careful examination of 9 ♂ *sicca* satisfies me that the last dorsal joint of the abdomen is, like the rest, piceous, and not ferruginous, as I have erroneously described it. It is the same in color as joints 1—8, in ♀ also.

Note 10, p. 170. I have described the first tarsal joint of the anterior leg ♂ ♀ *sicca* as "conspicuously pale, except at the incisures," by which last term I intended to comprehend the incisure between the 1st basal joint and the tibia. The incisures, therefore, as the ground color is said to be "piceous," are of course supposed to be piceous. I have also described the tip of the anterior tibiæ ♂ ♀ as black. It would have been more correct to say that both the tip of the tibia and the base of the 1st tarsal joint are black or fuscous. The tip of joint 1 and the whole of joints 2—5 of the anterior tarsi are, in reality, rather fuscous than piceous, but in a single ♂ specimen joints 2 and 3

are pale on their basal halves. The coloration of the anterior legs in both *arida* and *sicca* is so variable that it is difficult to fix it definitely without being unduly diffuse. To describe the *individual* is always easy; to describe the *species*, "hoc opus, hic labor est."

Note 11, p. 170. The difference between *arida* and *sicca* in the coloration of the setæ prevails only generally, not universally. In many other Ephemerina the setæ are sometimes immaculate, sometimes incised with fuscous, the more immature individuals having immaculate setæ like the subimago; e. g., *Palingenia interpunctata* and *P. flavescens* ♀. The more constant differences between *arida* and *sicca* may be thus tabulated from a careful comparison of numerous additional specimens; it is seldom that closely allied species can be so sharply separated.

	BÆTIS ARIDA Say, Walsh.	BÆTIS SICCA Walsh.
Dorsum of abdominal joints 1—8.	Piceous ♂, dark ferruginous ♀, with lateral basal pale ferruginous triangles or semicircles both ♂ and ♀.	Piceous ♂, dark ferruginous ♀, immaculate.
Last abdominal dorsal joint ♂ ♀.	Pale ferruginous.	Piceous ♂, dark ferruginous ♀.
Abdominal setæ ♂ ♀.	Pale greenish white, immaculate.	Pale greenish white, with slender fuscous incisures, sometimes obsolete except at base.
Cross-veins of the anterior wing ♂.	Pale greenish hyaline.	Fuscous.
Veins of the anterior wing ♂.	Pale greenish hyaline, sometimes tinged with fuscous towards the costa.	Fuscous.

In both species there is a narrow fissure between the eyes ♂ subimago when recent, which is absent in the imago. I was mistaken in supposing this fissure to be peculiar to *arida*, and I have observed the same character in the subimagos of some other Bætis. My observation on the comparative shortness of the ♂ front legs in *sicca* is only generally, not universally true. Individuals occur with the front legs as long as the body, and I have one now before me with the front legs

only $\frac{1}{2}$ as long as the body and one leg a trifle longer than the other. (See Dr. Hagen's remarks p. 176 lines 2—6.)

Note 12, p. 171. I have translated Dr. Williamson's description from the original Latin, either of Dr. Williamson or Dr. Hagen, but apparently the latter. The "two eggs" said to be laid by ♀, are no doubt the two long, cylindrical yellow masses, each consisting of numerous minute eggs, which are laid by so many other Ephemerina. Instead of having the vulvar aperture located under the tip of the antepenultimate ventral, as in Perlina and Odonata, Ephemerina have it located under the tip of the præ-antepenultimate, which, so far as I know, does not occur in any other family of Insects, and has not been noticed by authors. This species will, I suspect, prove to be congeneric with my *Cloe ferruginea* for the following reasons:—1st. It is said to have "no ocelli," and in *ferruginea* the eyes overhang and conceal the two posterior ocelli. 2nd. The hind wings are described as "narrower" than the others, as in all true Cloe that have any hind wings, and the wings are said to be "reticulate," which is true of all four wings in *ferruginea*, but not in any other Cloe known to me. 3rd. The subimago of *ferruginea* has the wings partly whitish hyaline, and the wings of *Bætis* (*palingenia*) *alba* Say are described by Dr. Hagen as "whitish with the anterior margin grayish" in the subimago. I doubt whether any Ephemerinous *imago* has opaque whitish wings, though *Palingenia Hecuba* Hagen, imago, is described as having "opaque grayish-rosy wings." Possibly in this case Dr. Hagen was led to believe the specimen to be an imago, because it had "a mass of eggs in the vulvar aperture," but I shall show afterwards that the subimago occasionally oviposits in *Palingenia bilineata*. (See Note 16, line 9.)

POTAMANTHUS.

Note 13, p. 172. I failed to identify *odonatus* Walsh with *nebulosus* Walker, because Mr. Walker's description says "anterior wings with a broad LONGITUDINAL fuscous BAND," by which I supposed him to mean a *vitta* extending from the base to the tip of the wing, as many authors, e. g., DeGeer, make no distinction between a *fascia* or band and a *vitta* or longitudinal stripe. It is very satisfactory that I should have referred to the right genus this fragmentary specimen, which had lost both the head and the abdomen, upon which parts and their appendages the ordinary generic characters in Ephemerina are

almost exclusively founded. The extreme tip of the front wing in my specimen is *not* hyaline, as Dr. Hagen supposes. By the words "terminal one-third of the wings dusky, *with a definite outline*," I intended to specify that the dusky part did not shade off gradually into the hyaline part.

As only the ♂ of *nebulosus* is at present known, it may possibly be the case that my specimen, which is deprived of all sexual characters, may be the ♀ of that species; and that the tip of the front wings being hyaline may be a mere sexual distinction of the ♂. Similarly in *Platthemis trimaculata* (Libellulina) the tip of the ♂ front wing is hyaline, and that of the ♀ front wing brown. And if, as both Dr. Hagen and myself think, *Psocus abruptus* and *Ps. corruptus* are the sexes of one species, we here have a subterminal hyaline semi-fascia, accompanied by a large discal hyaline spot, in ♂, and in ♀ merely a subterminal hyaline fascia. But on the above supposition we cannot refer to *nebulosus* the 6 doubtful ♀ ♀ from Saskatchewan, described by Dr. Hagen under *P. cupidus*, which have immaculate wings.

Note 14, p. 172. All my seven specimens of *P. cupidus* subimago have the four posterior tarsi brown-black, except two where they are rather dusky than brown-black. My unique specimen of *P. cupidus* ♂ imago was evidently an unusually small one, as becomes manifest from comparing the dimensions which I have given of the ♂ subimago.

Note 15, p. 173. As the wings of these six ♀ ♀ are said to be hyaline, it seems contrary to analogy that they should be identical with a ♂ which has the terminal $\frac{1}{3}$ of its front wing brown. Dr. Hagen does not state whether they agree with the ♀ *P. concinnus* from Washington. The descriptions agree tolerably well, but unfortunately the length of the intermediate seta of *P. concinnus* is not given in the Synopsis. The proportion of the exterior to the intermediate seta (15 to 8) in the six doubtful ♀ ♀ differs greatly from the proportion in my ♀ *cupidus* subimago, (10 to about 8); but it seems to be the general rule in Ephemera, that as a species progresses from larva through pupa and subimago to imago, the proportional length of the middle seta should gradually diminish. For example, in *Ephemerella flaveola* Walsh, the middle seta of the imago is to the other setæ as 14 to 20 ♂ and 10 to 12 ♀; while in the subimago the three are almost exactly equal. And it is well known that the genera with only two setæ developed in the imago

have larvæ with three tails nearly of equal length. Unfortunately the middle seta of my unique ♂ *P. cupidus* imago got lost in the handling, and I could only guess at its length. I have no doubt now that the length I formerly gave "about 16 mill," is much too great.

According to Dr. Hagen, the synonymy of the N. A. species of *Potamanthus* will stand thus:—

P. CUPIDUS Say, Walsh = *concinus* Walker = *pallipes* Walker = *tessellatus* Walker.

P. NEBULOSUS Walker = *odonatus* Walsh.

PALINGENIA.

Note 16, p. 174. I now possess ♀ ♀ of the group to which *P. vittigera* belongs and ♂ ♀ subimago. The ♀ differs most remarkably from the ♂ in the middle seta being nearly as long as the others, instead of being only about $\frac{1}{2}$ as long. In this respect, therefore, Group 5, or my subgenus A, agrees with Dr. Hagen's Group 2, but differs from that Group, 1st. in the anterior legs ♂ being very short and not much longer than those of ♀. 2nd. in the four hind legs being short. 3rd. in the ♀ not remaining in the subimago state. 4th. in the membrane of the wings not being "always folded up in the dead specimens."—As regards the 3rd point, I believe that, in certain species, the ♀ subimagos of which ordinarily moult, they occasionally do not do so; for I possess a ♀ subimago of *P. bilineata* Say, which oviposited in that state. Besides the two ♀ imagos of this 5th Group described below, I have met with two ♀ subimaginal integuments which evidently belong here, so that there can be no doubt that the ♀ subimagos commonly moult.

The discovery of the very curious fact, that the ♀ of this group has the 3 setæ subequal, will necessitate a revision of the Synoptical Table given on p. 368 of my Paper, in which I made an attempt to separate our N. A. genera of Ephemerina, without having recourse to sexual characters. As revised, the commencement of the Table will read as follows:—

	First tarsal &c.....	Ephemera.
Setæ 3, subequal.	Anterior legs ♂ ♀ nearly as long as the body.	Potamanthus.
	Anterior legs ♂ ♀ only $\frac{1}{2}$ as long as the body.	PALINGENIA subgenus A (= <i>Pentagenia</i> n.g.) ♀ only.
Setæ 3, the middle one short.....		PALINGENIA subgenus A (= <i>Pentagenia</i> n.g.) ♂ only.

The 3rd division of the 1st or sexual Synoptical Table (p. 367) must also be slightly amended, and read as follows:—

Eyes ♂ not contiguous, simple: (intermediate seta, when present, <i>subequal</i> , short, or rudimental.)	Legs all short; (intermediate seta <i>short</i> ♂, <i>subequal</i> ♀.)	PALINGENIA, subgenus A (= <i>Pentagenia</i> , n. g.)
	Legs &c.	PALINGENIA, subgenus B (= <i>Hexagenia</i> , n. g.)
	Legs &c.	PALINGENIA, subgenus C (= <i>Heptagenia</i> , n. g.)

While on this subject I may add, that in both the sexual and the non-sexual tables, in the 1st primary dichotomous division, instead of "costal cross-veins numerous, robust, regular," we should read "costal cross-veins distinct and plain on the middle of the costa"; and in the 2d dichotomous division, instead of "partially absent" or "entirely absent on some part of the costa," read "entirely absent in the middle of the costa." In *Hept. maculipennis* n. sp., the costal cross-veins are not "regular," but arranged in groups, and in *Bætis subgenus C*. they are entirely deficient, except the oblique vein next to the body, on the basal $\frac{1}{3}$ of the costa. In *Hept. simplex* again they are deficient, with the same exception, on the basal $\frac{1}{3}$ of the costa. Thus does Nature, even fruitful and abundant, mock the lagging labors of systematists!

In proposing the above three genera, I have followed Dr. Hagen's example, who has given the same termination to a number of new genera of Libellulina, founded by him, (*Celithemis*, *Plathemis*, *Lepthemis*, *Dythemis*, *Erythemis*, *Mesothemis*, and *Perithemis*), which is a great assistance to the memory in determining the position of those genera in a systematic arrangement. The new genera may be thus characterized:—

PENTAGENIA n. g. Wings four, hind wings wide, all with numerous cross-veins; costal cross-veins in the front wing numerous, never absent in the middle of the costa. First tarsal joint distinct in the anterior legs ♂ ♀, indistinct and connate in the four posterior legs ♂ ♀, in all the legs shorter than the 2nd tarsal joint; anterior tibia ♂ much longer than the femur; ant. ♂ legs not much longer than ant. ♀ legs; all six legs ♂ ♀ short, the hind legs not nearly attaining the tip of the abdomen. Intermediate seta short ♂, scarcely half the diameter of the other two; nearly as long as the others in ♀ and only slightly less robust; all the three setæ ♂ ♀ glabrous. Eyes ♂ separated by a

space about as wide as the orbit of the the posterior ocellus.—Species, *vittigera* Walsh, *quadripunctata* n. sp.

HEXAGENIA n. g. Wings four, hind wings wide, all with numerous cross-veins; costal cross-veins in the front wing numerous, never absent on the middle of the costa. First tarsal joint distinct in the anterior legs ♂ ♀, indistinct and connate in the four posterior legs ♂ ♀, in all the legs shorter than the 2nd tarsal joint; anterior tibia ♂ much longer than the femur; anterior ♂ legs very long, much longer than anterior ♀ legs; all the other ♂ ♀ legs short, the hind legs not attaining the tip of the abdomen. Two long abdominal setæ, pilose at the tip under the lens, the intermediate seta rudimental. Eyes ♂ separated by a space about twice as wide as the orbit of the posterior ocellus.—Species, *bilineata* Say, *limbata* Pictet.

HEPTAGENIA n. g. Wings four, hind wings wide, all with numerous cross-veins; costal cross-veins in the front wing numerous, never absent on the middle of the costa. First tarsal joint distinct and free in all ♂ ♀ legs, never longer than the 2nd tarsal joint; anterior tibia ♂ but slightly longer than the femur; anterior ♂ legs generally very long, and generally much longer than anterior ♀ legs; all the other legs long, the hind legs much more than attaining the tip of the abdomen. Two long, glabrous setæ; no intermediate seta. Eyes ♂ separated by a space at least as wide as the orbit of the posterior ocellus.—Species, *flavescens* Walsh, *interpunctata* Say, *pulchella* Walsh, *terminata* Walsh, *simplex* n. sp., *cruentata* n. sp., *maculipennis* n. sp.

PENTAGENIA n. g.

P. VITTIGERA Walsh. The ♀ differs in no material respect from the ♂. In the ♂, as well as ♀, the costa of the front wings is tinged with yellow, and instead of saying "abdomen piceous, &c., &c., &c., half-way to its tip," I should have said, "abdomen piceous on the central $\frac{1}{2}$ or $\frac{2}{3}$ of the dorsum, the piceous vitta on each segment having its sides nearly straight, except that they are a little convergent behind, and having also two narrow yellowish divergent basal vittæ extending half-way to its tip." The eyes ♂ in life are yellow on their upper $\frac{2}{3}$ and dark ferruginous on their lower $\frac{1}{3}$; and in all ♂ ♀ legs tarsal joints 2—4 regularly and but moderately diminish in length.—Length ♂ 17—18 mill. ♀ 16 mill. Exp. ♂ 30—32 mill. ♀ 36 mill.

Seta ♂ 24 to about 35 mill. ♀ deficient. Ant. leg ♂ 9 mill. ♀ (same size) $7\frac{1}{2}$ mill. Two ♂, one ♀.

The ♀ subimago has the coloring of the abdominal dorsum dull and opaque, and the yellowish vittæ obliterated, but the shape of the dark vitta still remains discernable. The wings are dull opaque yellowish.—Length ♂ 19 mill. ♀ 18—20 mill. Exp. ♂ 33 mill. ♀ 38—40 mill. Seta ♂ 18 mill. ♀ 13 mill. Interm. seta ♂ $4\frac{1}{2}$ mill. ♀ $10\frac{1}{2}$ mill. One ♂ from which I bred an imago; two ♀.—The only specimen I formerly had of this species was a ♂, found entangled in a cobweb. In disengaging the insect the setæ got broken in pieces, except about $\frac{1}{2}$ of their length, but I guessed them at "about 40. or 50 mill." The additional ♂ I now possess was bred from a subimago, the setæ of which measured 18 mill., and those of the subimaginal integument 19 mill. This ♂ died before its setæ became fully developed, but they measure now about 24 mill. As the setæ of the ♂ imago in the allied *P. bilineata* and *P. limbata* are much more than double those of the ♂ subimago, we may safely estimate the seta of ♂ *vittigera*, imago, at about 30 or 35 mill., when fully developed, those of the subimago being 18 or 19 mill. The seta of the female imago of the next species measures $22\frac{1}{2}$ mill., and that of the ♀ subimago 17 mill.; but it is a very general rule in Ephemerina that the ♂ setæ and ♂ front leg are proportionally much more elongated than the ♀ setæ and ♀ front leg, on assuming the imago state.

P. quadripunctata n. sp.

The imago ♀ differs from the preceding species (*P. vittigera*, Walsh) only as follows:—1st. There are four distinct fuscous dots, each surrounded by a slight cloud and conspicuous to the naked eye, on the front wings, extending in a slightly curved line from the middle of the costa to the centre of the disk; viz., one on the 2d vein of the costa, and one on the 4th, 6th and 9th veins respectively from the costal edge. In *vittigera*, imago and subimago, no traces whatever can be discovered of any such dots. 2nd. The piceous vitta of each abdominal segment, instead of having its sides nearly straight, has them sharply angulated, so that the vitta of each segment forms a regular hexagon.—The small yellowish vittæ included in the piceous vitta are here subobsolete, but are very distinct in the ♂ subimago.—Length ♀ $19\frac{1}{2}$ mill. Exp. ♀ 40 mill. Seta ♀ $22\frac{1}{2}$ mill. Interm. seta ♀ $19\frac{1}{2}$ mill. One ♀; ♂ unknown.

The ♂ ♀ subimago differ from *vittigera* in the same two characters as the ♀ imago. In ♂ the coloring is unusually bright, but the setæ are pilose and the wings fringed under the lens. Both ♂ ♀ differ from ♀ subimago of *vittigera* in the wings being whitish-opaque, instead of yellowish-opaque.—Length ♂ 19 mill. ♀ 22 mill. Exp. ♂ 32 mill. ♀ 41 mill. Seta ♂ 15 mill. ♀ 17 mill. Interm. seta ♂ 3 mill. ♀ 14 mill. One ♂, one ♀.

Note 17, p. 175. P. BILINEATA Say, and P. LIMBATA Pictet. Nothing is easier than to distinguish living specimens of these insects by the color of the eyes. In the former the upper half of the eyes is cinnamon-brown, in the latter bright greenish yellow; in both the lower half of the eyes is black. The dried specimens, especially those of ♂, are very difficult to distinguish. I incline to believe that both the abnormal ♂ from Rock Island, the 3 ♂ from Chicago, the ♂ from Red River (Uhler), and the ♂ habitat unknown, are all properly referable to *limbata* and not to *bilineata*. In the middle of July, when on the shallow arm of the Mississippi, known as "the Slough" at Rock Island, *bilineata* appears in prodigious swarms, so that the bushes absolutely bend down with their weight, I examined many hundred ♂ ♂, but could not find a single one with the setæ other than dusky-brown to the naked eye, although under the lens there is occasionally a very small whitish annulus, as is noticed in Dr. Hagen's description, at the base of the joints. The ♀ ♀, on the contrary, almost universally had the setæ very pale brown, verging on white towards the tip and darker at base, with conspicuous dark brown incisures, which were scarcely ever absent. In no one instance could I perceive an individual ♂ with the setæ as they are described by Dr. Hagen in the 3 ♂ from Chicago, and as they are in ♂ *P. limbata*, viz., brown with the basal half of the joints pale. Neither could I see a single individual ♂ or ♀ with the tips of the hind wings hyaline, as they are said to be in the abnormal ♂ from Rock Island, and in the ♂ without habitat. Lastly, I am sure that in the thousands of individuals both ♂ and ♀ which blackened the bushes, there was not one with the upper surface of the eyes yellow or yellowish; the only variation I noticed from the normal color was, that one ♂ had the eyes a shade or two paler than the rest on their upper surface. I have now before me in the dried specimen 13 ♂ 18 ♀ of *bilineata*, and 5 ♂ 3 ♀ of *limbata*, and the following Table

expresses such differences between the two species as I find to be pretty constant, all exceptions that occur being carefully noted.

	P. BILINEATA Say. (= <i>limbata</i> Hag. Synops.)	P. LIMBATA Pictet. (= <i>bilineata</i> Hag. Synops.)
Prothorax.	Black in front and laterally, as described in Synopsis.	Black laterally only, as described in Synopsis.
Spots on each side of the joints of abdominal dorsum.	Yellowish white, medial, suboblong or elongate-triangular; lateral tip of each joint brown.	Yellow or fulvous, basal, equilaterally triangular: lateral tip of each joint with a similar fulvous or yellow triangle.
Anterior legs ♂ ♀.	Fuscous immaculate, base of tarsal joints 2—4 paler only in two ♀.	Fuscous, base of tarsal joints 2—4 whitish or yellowish, except in a single ♂.
Four hind legs ♂ ♀.	Femora dull greenish, knees and the rest of leg fuscous.	Bright clear yellow, tips of a few of terminal tarsal joints, and the whole of 5 fuscous.
Beta ♂.	Dark fuscous brown, the joints occasionally with a very narrow basal whitish annulus.	Whitish, terminal $\frac{1}{2}$ of each joint brown: joints sometimes alternately 1 all brown and 1 all white, or 2 all brown and 1 all white.
Beta ♀.	Very pale brown, darker at base, whitish at tip, almost always with fuscous incisures.	Whitish, with brown incisures obsolete at tip, in a very immature ♀ obsolete except at the extreme base. Incisures sometimes irregularly wide & narrow.
Veins at the extreme base of all four wings ♂ ♀.	Dusky.	Hyaline.
Veins in all four wings ♀ except at the extreme base.	Dusky or black.	Yellowish, more or less partially tinged with dusky.
Terminal edge of hind wings.	Fuscous ♂ ♀.	Fuscous or clouded ♂, hyaline or clouded ♀.

In all my ♂ specimens both of *bilineata* and *limbata* the anterior leg is nearly as long as the body, but proportionally a little longer in the former than in the latter; whereas in the abnormal ♂ from Rock Island, described above by Dr. Hagen, the anterior ♂ leg is only $\frac{1}{2}$ as long as the body. In 9 ♂ *bilineata*, measured while they were alive, the

body was $15\frac{1}{2}$ — $23\frac{1}{2}$ mill. and the seta 58—74 mill., or more than three times the length of the body. In 3 ♂ *limbata*, measured when dried, the body was $13\frac{1}{2}$ —19 mill., the expanse 28—40 mill., and the seta 35—52 mill.; the seta being considerably less than three times the length of the body. On the other hand, in Dr. Hagen's abnormal ♂ the seta is not much more than half as long again as the body. As in the ♂ subimago of both these two species the anterior legs and the setæ are short and the setæ brownish immaculate, I should conceive that the abnormal ♂ must have been a specimen which died immediately after moulting, before the anterior legs and setæ had time to expand to their proper proportions, and the setæ to acquire their proper coloring. I noticed above, under *Bætis sicca* Walsh, an abnormal ♂ with the anterior legs proportionally short. It may be added here, that both in *bilineata* and *limbata* in the anterior leg of the ♂ imago the tibia is about $\frac{1}{2}$ longer than the femur, varying a little in different individuals; while in ♀ imago and in ♂ ♀ subimago the tibia of the anterior leg is but very slightly longer than the femur. Upon the above hypothesis, this fact serves to explain why in Dr. Hagen's abnormal ♂ the femur is 3 mill., and the tibia only $3\frac{1}{4}$ mill. In 17 ♀ *bilineata*, measured while alive, the length of the body was 17—30 mill., the seta 30—54 mill., and the anterior leg scarcely more than half as long as the body.

Note 18, p. 177. I conceive this doubtful ♀ from Rock Island to be a mere variety of *P. limbata* Pictet (*bilineata* Hag. Synop.). As to the six differences pointed out above by Dr. Hagen, 1st. My three ♀ of *limbata* measure, body $15\frac{1}{2}$ —20 mill., expanse 38—43 mill., seta 26—30 mill., the specimen with the *shortest* body having the *widest* expanse. I have even a ♀ of *bilineata*, selected from among a crowd of others, some but a trifle smaller, the body of which when recent measured 30 mill. and when dry 23 mill., the expanse being 55 mill. or 3 millimetres more than that of the doubtful ♀. Yet the *usual* dimensions of *bilineata* and *limbata* are about the same, except the setæ. 2nd. The prothorax generally contracts longitudinally in drying and its shape is not a reliable character. 3rd. Of 5 ♂ 3 ♀ *limbata* before me scarcely two have the abdomen exactly alike, the dorsum in some having the blood-brown color dominant, and in others the yellow dominant, with all the intermediate grades. 4th. In the four hind legs of the 5 ♂ 3 ♀, some-

times the tip of tarsal joints 1—4 is brown, sometimes only the tip of 3 and 4 or of 4 only. 5th. In two of my ♀ *limbata* the wings are yellowish; in one they are subhyaline with a slight smoky tinge, as they also are in my ♂. 6th. The intermediate seta generally shrinks in drying and is not reliable. Sometimes in the dried specimen it can scarcely be distinguished, but in the living insect it is always easily seen by the naked eye.

I believe that in *bilineata* and *limbata* the terminal $\frac{1}{2}$ of the seta of the ♂ ♀ imago is always pilose under the lens—a thing which I have not noticed in the imago of any other Ephemerinous group but my *Bætis* § A, and there only in the extreme tip. This is also stated by Dr. Hagen as a character of the ♀ of his second group, with a query that the ♀ remains in the subimago state like the first group. In that case the seta would probably be hairy, not merely at the tip but throughout its length. Has the ♂ also of this second group a seta hairy at the tip, like the ♂ of *Hexagenia* n. g., the sixth group?

On the whole, I am satisfied that at Rock Island we have only two species of this group—*bilineata* and *limbata*—the former of which occurs in prodigious swarms and only on the banks of the Mississippi, in the middle of July; the latter occurs very sparsely and often as much as a mile from the nearest river. I found the former in similar profusion on the Ohio river in South Illinois, in the middle and latter end of July, 1861, so that I suspect it is confined to large rapid rivers. It is possible that some of Dr. Hagen's specimens may belong to a third species, with which I am unacquainted. Foreign entomologists, who can only study N. A. Ephemerina in the dried specimen, labor under great disadvantages, not only because the setæ of the specimens which reach them are frequently mutilated, or badly shrivelled, but because one of the best and most constant characters, the color of the eyes, is entirely obliterated in death, to say nothing of the great difficulty of ascertaining from the generally shrivelled eyes of the dried specimen whether these organs are single or double.

Note 19, p. 177. Every spring many acres of log-rafts are floated down to the Rock Island saw-mills from the pineries in Wisconsin and Minnesota. Amongst the floating rubbish that accumulates between the logs breed myriads of Ephemerinous pupæ, which may be often noticed crawling out on to the logs to assume the subimago state. As these

rafts come from various rivers which empty into the Mississippi, it happens, as we might *a priori* anticipate, that from time to time new Ephemerinous species are imported amongst us. This may account for the fact, that although in 1862 I pretty thoroughly explored the neighborhood of our saw-mills, yet in 1863 I have met with several species in considerable abundance which were previously unknown to me. On the other hand, of several species that were abundant in 1862, I have in 1863 met with only one or two specimens, e. g., *Potamanthus cupidus*, *Bætis alternata* and *Bætisca obesa*.—This may, however, be partly explained by the fact that in 1863 the Mississippi has been unusually low and comparatively but few log-rafts have come down.

P. PULCHELLA Walsh, and *P. TERMINATA* Walsh. I am not sure but these two species are identical. I had supposed that the presence of fuscous dots in *pulchella*, located on the spiracles of the pale segments of the abdominal dorsum, was a constant character ♂ ♀; but out of many dozen individuals examined in 1863, I find a ♂ with these dots subobsolete and another with them obsolete. Although *pulchella* has been abundant in 1863, I have not seen a single *terminata*, so as to determine with precision the color of its eyes. *Pulchella* certainly has them "pearly-whitish," and from my general recollection that the eyes of *terminata* were yellow, I stated them in my description to be "generally yellowish." In this, however, I may possibly be mistaken, for I was not in the habit in 1862 of noting the color of the eyes in the field, and these organs often turn black in the interval between capture and death, sometimes both, and sometimes only one. The only *constant* distinguishing character that remains is, that the four hind legs and the abdominal joints 1—6 are pure whitish in *pulchella* and pale yellowish in *terminata*, which, unsupported by a constant and decided difference in the color of the eyes, would not be sufficient to separate such closely allied species. Here, as elsewhere, it is easy to separate two *individuals*, but to separate two *species*, when specimens are greatly multiplied, is a far more difficult undertaking.

As to Dr. Hagen's remark on the probable identity of *P. pulchella* Walsh, and *Bætis verticis* Say, there is some clerical or typographical error in the figures given in the Synopsis. Say says that *B. verticis* is "over one-fourth of an inch long," and the setæ "over three-tenths," which in millimetres would be about 7 and 8; and he says likewise

"setæ hardly longer than the body." Yet the figures given in the Synopsis under *B. verticis* Say, are 8 and 24 respectively. Now the setæ of *pulchella* are 17—22 mill., and it can scarcely therefore be identical with a species which, according to its describer, has setæ only 8 millimetres long. If *B. verticis* Say, is ever identified, I should conceive, from the ornamentation of the legs and the description of the hind wings, that it will probably prove to be a *Cloe*.

The following belong to the same group (*Heptagenia* n. g.) as *P. pulchella* Walsh.

HEPTAGENIA n. g.

H. simplex, n. sp.—♂ Golden-yellow ranging to whitish. *Head* with the eyes bright greenish yellow in the living insect above and below; orbits of ocelli blackish. Upper surface of *thorax* flesh-colored. *Abdomen* and *venter* perfectly hyaline and immaculate, except the last two or three joints, which are opaque yellowish or whitish; setæ white, tinged with dusky at the extreme tip; anal appendages white. *Legs* white, the femora yellow or yellowish, and the extreme tips of all the tarsi and in the anterior legs the tips of the tibiae and sometimes the tarsal incisions, fuscous. *Wings* hyaline, veins and cross-veins fine, subequal, the cross-veins on the terminal $\frac{1}{2}$ of the costa coarse, on the other $\frac{3}{4}$ very fine, and entirely absent, except the oblique basal vein, on the basal fifth of the costa; veins and cross-veins in both wings hyaline except on the terminal $\frac{1}{2}$ or $\frac{3}{4}$ of the front wing where they are fuscous, all the costal cross-veins being occasionally fuscous.

The ♀ differs from ♂ as follows:—The abdomen and venter are egg-yellow, except where the eggs have been extruded. The setæ are scarcely tinged with dusky at tip. All six legs have only the extreme tip of the tarsus a little tinged with fuscous. All the veins and cross-veins are hyaline, except a few cross-veins towards the costal tip which are dusky, and the costal veins which have a yellowish tinge.—Length ♂ 6—8 mill. ♀ 7—8½ mill. Exp. ♂ 16½—20½ mill. ♀ 21—22½ mill. Seta ♂ 14—18½ mill. ♀ 14—16 mill. Ant. leg ♂ 6½ mill. ♀ (same size) 6 mill.

Ten ♂, nine ♀.

The ♂ ♀ subimago differ only in the usual way from the imago. The wings, as well as their veins and cross-veins, are yellowish, all the veins and cross-veins, except on the costa of one ♀, untinged with fuscous.—Length ♂ 6 mill. ♀ 6½—9 mill. Exp. ♂ 16 mill. ♀ 19—25½ mill. Seta ♂ 10½ mill. ♀ 10—15 mill. One ♂, four ♀.—This species is remarkable for the unusual shortness of the anterior tarsus, which never exceeds $\frac{3}{4}$ the length of the tibia in ♂, and $\frac{1}{2}$ the tibia in ♀, whereas in *pulchella* ♂ it is generally from $\frac{1}{4}$ to $\frac{1}{2}$ longer than the tibia and in *pulchella* ♀ about as long as the tibia. It differs also from its congeners.

except *pulchella*, *terminata* and *maculipennis* n. sp., in the first tarsal joint in all ♂ ♀ legs being as long as the second, instead of being somewhat shorter, joints 1—4 being subequal, 4 a trifle the shortest. I met with a single ♀ subimago of this species in 1862, and laid it aside as a "nondescript." In 1863 the species was abundant in June, near one of our saw-mills. No less than 5 of the ♂ specimens described have the eyes fully rounded out, which is the surest sign of maturity both in *Ephemerina* and *Odonata*, so that they cannot be considered as immature and colorless individuals of some other species. The colorless specimens of *terminata* described by me have their anterior tarsi as long as fully colored specimens.

H. cruentata, n. sp.—♂ Yellowish. *Head* with the eyes in the living insect pale bluish gray, a black line dividing the upper $\frac{2}{3}$ from the lower $\frac{1}{3}$; ocelli fuscous; vertex sanguineous: seta dusky, whitish at tip. Upper surface of *thorax* sanguineous. Dorsum of *abdomen* sanguineous, the overlapping portion of the segments darker. Anal appendages pale, fuscous at tip; setæ whitish, the incisures fuscous and towards the base alternately wide and narrow. All six *legs* with the terminal $\frac{1}{2}$ of the femora, and the basal $\frac{1}{2}$ and terminal $\frac{1}{2}$ of the tibiae, pale sanguineous, the sanguineous part of the femora darker at each extremity, so as to present a narrow medial and terminal dark annulus; all the six tarsi with their claws and incisures dusky. *Wings* hyaline; veins and cross-veins moderate, the veins finer than the cross-veins, all fuscous except at the extreme base of the wing and the basal $\frac{3}{4}$ of the costa, where the veins are respectively hyaline and yellowish; the costal cross-veins all, including the oblique basal vein, of uniform coarseness, and the costa uniformly tinged with yellow. Half way to the tip of the front wing the 2nd costal vein is thickened and obfuscated for the length of half a millimetre, as in *flavescens* Walsh, and generally in *pulchella* Walsh.

The ♀ is occasionally paler than ♂, and occasionally the venter is sanguineous. In two specimens there is a pair of subobsolete pale dorsal vittæ on each abdominal joint. The hyaline portion of the wing-veins extends a little further than in ♂, particularly in the hind wings.—Length ♂ $7\frac{1}{2}$ —8 mill. ♀ 8—9 mill. Exp. ♂ 19—20 mill. ♀ 22—23 $\frac{1}{2}$ mill. Seta ♂ 25—27 mill. ♀ 17—20 mill. Ant. leg ♂ $9\frac{1}{2}$ mill. ♀ (larger) $7\frac{1}{2}$ mill.

Two ♂; three ♀.

The ♂ subimago, from which I have bred the imago, differs as usual. The setæ are tinged with dusky, the fuscous incisures less obvious. In 1 specimen the markings of the legs are much paler. In both, the wings, as well as all their veins and cross-veins, are dull opaque yellowish.—Length ♂ 7 mill. Exp. ♂ 20—21 mill. Seta ♂ 12—14 mill. Two ♂; ♀ unknown.—Closely allied to *flavescens* Walsh, but much smaller, and the eyes are not bright greenish yellow as in that species. Differs also

in the uniform coloring of the costa, and in the very remarkable ornamentation of the legs and especially the tibiae. In *flavescens* ♂ the anterior tarsus is a trifle longer than the tibia; in *cruentata* ♂ it is the same length. In *flavescens* ♀ it is a trifle shorter, in *cruentata* ♀ $\frac{1}{4}$ shorter. In both species the first tarsal joint is slightly shorter than the second in ♂ ♀ four hind legs, shorter in ♀ anterior legs, and much shorter in ♂ anterior legs, and corresponding differences are observable. in the other species of this genus. between the different ♂ ♀ legs. except in *H. simplex* where ♂ ♀ anterior tarsi are abnormally short.

H. maculipennis, n. sp.—♂ Pale yellowish. *Head* with the vertex ferruginous; orbits of ocelli and antennal seta dusky. *Thorax* ferruginous above. Dorsum of *abdomen* with the terminal $\frac{3}{4}$ of joint 6, the whole of 7 and 8 and the extreme base of 9, piceous; anal appendages and setae whitish. *Legs* whitish, the femora yellowish and generally with a short fine fuscous vitta beneath at tip; all six tarsal claws and the extreme tips of the anterior tibiae, fuscous. *Wings* hyaline; veins fine and dusky, cross-veins coarse and black, except on the inner submargin of the front wing and the entire hind wing, where both veins and cross-veins are all hyaline. On the costa of the front wing the cross-veins are coal-black and arranged as follows, giving the appearance of spots:—at the base about four at the usual distance, the 1st in both rows and the next three in the costal row heavily bordered with black, then an open space, then on the middle of the costa a group of about three cross-veins close together and bordered with black, then a space with fewer cross-veins than usual, then at $\frac{3}{4}$ the distance to the tip another similar group of four or five similarly bordered, then cross-veins at the usual distance as far as the tip.

The ♀ is paler than ♂, and the terminal dorsal joints of the abdomen are whitish-opaque more or less tinged with ferruginous. The tip of the anterior tibiae is scarcely ever fuscous, and the costal markings are rather paler.—Length ♂ $4\frac{1}{2}$ —6 mill. ♀ 5—6 mill. Exp. ♂ 14—17 mill. ♀ 15—17 mill. Seta ♂ 12—15 mill. ♀ 9—12 mill. Ant. leg ♂ 8 mill. ♀ (same size) 5 mill.

Eight ♂, seven ♀.

The subimago ♂ ♀ differs as usual. The setae are tinged with dusky at tip; the wings are tinged with dusky, and all the cross-veins are slightly bordered with dusky.—Length ♂ ♀ $4\frac{1}{2}$ mill. Exp. ♂ 14 mill. ♀ $15\frac{1}{2}$ mill. Seta ♂ $7\frac{1}{2}$ mill. ♀ 8 mill. One ♂, one ♀.—A well marked species, remarkable for the arrangement of the costal cross-veins. In the anterior ♂ leg, tarsal joint 1 is about $\frac{1}{2}$ of 2, in anterior ♀ leg joint 1 is about $\frac{3}{4}$ of 2; in both ♂ ♀ anterior legs the tarsus is longer than the tibia; in the four hind legs ♂ ♀ joint 1 is the same length as 2, as in *pulchella*, *terminata* and *simplex*.

EPHEMERA.

Note 20, p. 178. *E. myops* n. sp.

The ♂ of this species differs from *E. flaveola* Walsh, only in the following respects:—The size is much larger, the expanse of the smallest *myops* being 7 millimetres greater than that of the largest *flaveola*, of which 15 specimens have been measured by me; yet the eyes are not only relatively but absolutely smaller, and are separated by a space $2\frac{1}{2}$ times their own diameter instead of only by one diameter. The lateral abdominal fuscous vitta found in *flaveola* is absent, which however occurs also in two specimens of *flaveola*. In the more mature specimens both venter and abdomen are ferruginous from 1 to 5, 6 and 9 paler, 7 and 8 yellowish; in the other specimen the whole abdomen is yellowish, and I think it was so with both in the living insect.—Length ♂ 12—18 mill. Exp. ♂ 26—27 mill. Seta ♂ 27—29 mill. Interm. seta ♂ 19—21 mill. Ant. leg ♂ 11 mill. Two ♂; ♀ unknown. One ♂ was bred from the subimago, and the subimaginal integument having been preserved shews the three setæ to have been exactly equal and 16 mill. long. But for the eyes, which give this insect the appearance of a ♀ *Bætisca*, I should have supposed it to be a mere variety of *flaveola*.

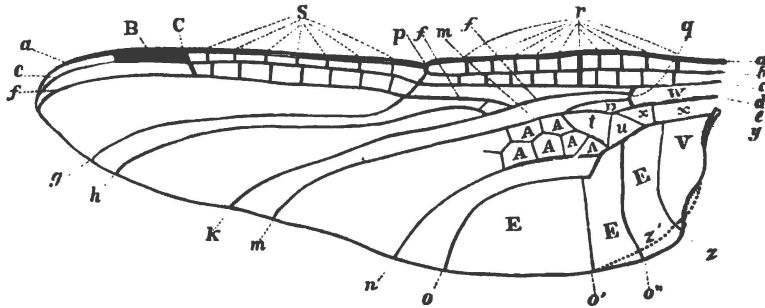
CLOE.

Note 21, p. 178. *C. vicina* Walsh, non Hagen. Say gives the length of *C. posticata* as $7\frac{1}{2}$ or 8 mill., and the setæ 18 or 19 mill., describing only the ♂ imago. Of 7 ♂ imagos of *C. vicina* Walsh, measured by me—and I had noticed many more in the field which did not appear any larger—the length was 4—5 mill. and the seta $7\frac{1}{2}$ —10 mill. Is not this rather too great a discrepancy to allow us to consider the two species identical? *Vicina* being preoccupied, I should propose for my species, if it be really new, the name of *propinqua*.

ODONATA.

N. B. The following drawing of the *hind* wing of *Gomphus*, copied with a few additions from the original of Dr. Hagen, (Mon. Gomph. Pl. 22,) is intended to illustrate the pterological nomenclature of Odonata. With the exception of the anal angle (α), and the anal triangle (∇), the same parts with the same names occur slightly modified in the *front* wing of *Gomphus*, and generally in both wings throughout Odonata,

with the following exceptions, which are peculiar to the subfamilies Calopterygina and Agrionina.—1st. The triangles, (*t* and *u*, discoidal and internal) entirely disappear, and the submedian vein (*d*) is continuous with its prolongation (*n*, the first or upper sector of the triangle) without being angulated and osculating with the postcostal vein (*e*) at the lower angle of the triangle (*t*) in order to form one side of that triangle, as is the case in the other four subfamilies, including of course *Gomphus*.—2nd. The “area above the Triangle” (*D*) (*espace au dessus du Triangle*) assumes the form of an elongated, but more or less irregular, parallelogram in Calopterygina and in certain genera of Agrionina (e. g. *Megaloprepus*, *Palæmnema*, *Protonevra* and *Trichocnemis*), or of an elongated trapezium with its upper side shorter than its lower side, in the remaining genera of Agrionina. This difference arises from the lower side, i. e. the side facing the anal angle (*z*), being always greatly elongated in both subfamilies, and the side adjoining the Triangle (*t*) being greatly shortened and made subparallel with the side facing the base of the wing in Calopterygina and in the exceptional genera of Agrionina, or elongated and directed towards the basal portion of the costa in the remaining genera of Agrionina. Thus modified this area is called “the quadrangle” or “the quadrilateral.”—3rd. In consequence of the above modifications, the upper and lower sectors of the triangle (*n* and *o*,) which still retain the same name, spring immediately from the upper and lower corners of the “median area” (*x*), the triangles which intervene in the other four subfamilies being obsolete and there being consequently no osculation of *d* with *e*.



VEINS (or principal nervures).—*aa*, costal vein. *b*, subcostal vein. *cc*, median vein. *d*, submedian vein. *e*, postcostal vein.

SECTORS (branches springing from areas, veins, cross-veins, or other sectors).—*fff*, principal sector. *g*, nodal sector. *h*, subnodal sector. *k*, median sector. *mm*, short sector. *n*, upper sector of the Triangle. (normally a prolongation of *d*.) *o*, lower sector of the Triangle. (normally a prolongation of *c*.) *o'*, *o''* its branches, (*rameaux*.)*

CROSS-VEINS.—*p*, nodus. *q*, arc or arculus. *rrr* ---- antecubitals.†
sss ---- postcubitals.

AREAS and ANGLES.—*t*, THE TRIANGLE, (discoidal.) *u*, internal triangle. *V*, anal triangle. *W*, basal area (or space.) *xx*, median area (or space.) *y*, membranule. *z*, anal angle in ♂, the dotted line *z'* shewing the form of the anal corner of the wing in ♀ *Gomphus*.‡ *AA*----, discoidal areolets, (in the figure, two ranges of them commencing with three.) *B*, Pterostigma. *C*, its basal (or internal) side prolonged in the normal manner. *D*, "quadrangle," "quadrilateral," or "area above the triangle," bounded above by *m*, below by *d*, basally by *q*, and terminally by an unnamed cross-vein. *EEE*, Postcostal area (or space.)

Of the above pterological parts, *q* and its sectors, *r*, *s*, *t*, *W*, *y*, *B*, and in Calopterygina and Agrionina "the quadrilateral" (*D*) and "the postcostal area" (*E*) are the most important in Classification. When in Odonata "antecubitals" and "postcubitals" are spoken of, the anterior or costal series of each, in the front wing, is always meant, unless express reference is made to the antecubitals and postcubitals of the hind wing, or to their posterior or subcostal series. The triangles are said to be "free" (*libres*) or "empty" (*vides*), when, as in *Gomphus*, they are not intersected by cross-veins. In *Gomphoides*, *Cordulegaster*, and most other triangle-bearing Odonatous genera they are so intersected. The discoidal Triangle (*t*) is usually called simply "the Triangle." In all my *Gomphus* (60 or 70 specimens of different species, including *Macrogomphus spiniceps* Walsh) the first and fifth antecubitals are more robust than the others both in the costal and subcostal series, and are

* The figure gives an angle where *o'* bifurcates from *o*, which should have been a flowing curve. Both *n* and *o* should have been engraved as springing from the lower angle of the triangle (*t*).

† The basal antecubital is wrongly engraved as dislocated with that of the 2nd or subcostal series.

‡ The angle *z* ought to have been engraved as much more acute and salient.

never "dislocated" as the other antecubitals are towards the nodus, (p.) In the Asiatic type of *Macrogomphus*, however, it is the 1st and the 7th, not the 1st and the 5th antecubitals which are thus thickened. In *Æschna (constricta)* and *Anax (junius)* the medial antecubital which is thus thickened and not dislocated varies in the same species, in the same sex, and sometimes even in the right and left wings of the same individual, from the 6th to the 7th; thus proving that in *Æschnina*, at all events, this character is not even of specific, much less of generic or subgeneric value.

HETÆRINA.

The following Table of the sub-groups of the subgenus *Hetærina*, copied with additions from Selys and Hagen's *Monogr. Calopt.*, will probably be found both useful and interesting. Of this subgenus 31 species, all American, are now described, 9 of which exist in the U. S. and probably many more remain to be discovered.

Pterostigma absent ♂ ♀	Tibiæ black	Tip of ♂ hind wings hyaline	1 species, S. A.
		Tip of ♂ hind wings with a red spot,	8 sp. S. A. and 1 sp. U. S. (<i>septentrionalis</i> .)
		Tip of all 4 ♂ wings with a red spot,	4 sp. S. A.
	Tibiæ "superiorly" (or exteriorly) pale. (Tip of ♂ wings with no spot.)		2 sp. N. A. and 8 A. and 1 U. S. (<i>californica</i> .)
Pterostigma present ♂ ♀, sometimes rudimentary.	Tibiæ "superiorly" (or exteriorly) pale. (Tip of ♂ wings with no spot.)		4 sp. U. S. (<i>americana</i> , <i>basalis</i> , <i>pseudamericana</i> n. sp. and <i>texana</i> n. sp.)
	Tibiæ black.	Tip of ♂ wings, especially the hind ones, bordered with brown.	1 sp. S. A. 1 sp. N. A. & 3 sp. U. S. (<i>tricolor</i> , <i>rupeus</i> , <i>insulensis</i> Walsh and <i>rupinensis</i> n. s.)
		Tip of all 4 ♂ wings with a brown spot.	1 sp. S. A. and 1 sp. N. A.
		Tip of ♂ hind wings with a brown spot.	1 sp. N. A.
		Tip of ♂ hind wings with a red spot.	1 sp. S. A.
		Tip of all 4 ♂ wings with a red spot.	1 sp. S. A.

H. AMERICANA? Fabr. A single ♂, which I refer with some hesitation to this species chiefly because the ♂ abdominal appendages agree both with the figure and with the description in the *Monographie*, was

taken by me at the end of August on Rock River, Ill. There is, it is true, a small but distinct tubercle above on the posterior base of the median laminiform tooth of the appendage, which is not specially mentioned in the *Monographie*; but as this tubercle exists in both my other species of this subgroup, it probably exists also in *americana*. The carmine-red basal spot on all the 4 wings extends about $\frac{1}{2}$ the way to the nodus, or 11—12 cellules beyond the quadrilateral in the front wing and 8—9 cellules beyond the quadrilateral in the hind wing. Now *americana* ♂ is described as having the carmine-red spot reach only $\frac{1}{2}$ the way, instead of $\frac{1}{2}$ the way, to the nodus; and in a ♂ specimen sent me by Mr. Uhler, which however as it has lost most of its abdomen cannot be identified with certainty, it reaches in the front wing 5 cellules beyond the quadrilateral and in the hind wing 3. I observe, however, that in *rupamensis* ♂ n. sp. there is a variation of 2 and 5, and in *pseudamericana* ♂ n. sp. a variation of 2 and 4 cellules in the extent of the basal spot in the front and hind wings respectively; and as a character which is variable in one species may generally, I think, be assumed to be more or less variable in closely allied species, we may disregard in this specimen the unusual extent of both basal spots, being about 6—7 cellules of overplus. Again, in *americana* ♂ the basal spot is described as “leaving the costal margin free almost for its whole extent” in the front wing, and “leaving the postcostal margin free from opposite the arc” in the hind wing; (*Monogr.* p. 132.) and such is the case also in the specimen from Mr. Uhler. In my ♂ the spot on the front wing leaves the costal margin at $\frac{1}{2}$ its own length from the base of the wing; and that on the hind wing leaves the postcostal margin at $\frac{1}{2}$ its own length from the base of the wing; the other two margins are touched by the spot throughout its entire length. But in these points, too, I find very considerable variation in the above named two species. There are also some other less important and equally variable characters in which our insect differs from the description, viz. 1st. The entire second joint of the antennæ is brown, instead of being “brown at each end;” but it is also uniformly brown in the Uhlerian specimen of *americana*. 2nd. The pterostigma is black, instead of “reddish-brown” in the mature ♂ and “yellow” in the immature ♂. 3rd. The epistoma is brassy-green, and the top of the head and the dark parts of the thorax coppery-red, as is also the

case in the Uhlerian specimen. The *Monographie* describes the epistoma as "bronze-green," the top of the head as "golden-green;" and the thorax as "coppery-green in front" and "bronze-green" on its sides. In Dr. Hagen's Synopsis the general color of ♂ is said to be "coppery." In the above-quoted two species (*rupamensis* and *pseud-americana*) I find the coloration in these parts to be very variable. As is also the case in the Uhlerian specimen of *americana*, the postocipital tubercles of this specimen are obtuse, which character however is omitted in the *Monographie*.—Antecubitals 25—26; postcubitals 25—27; 9—13 cross-veins to the 4 quadrilaterals; 6—8 cross-veins to the 4 basal areas. Length ♂ 47 mill. Expanse ♂ 58 mill. Abd. ♂ 38 mill. Front wing ♂ 30½ mill. Hind wing ♂ 29 mill. One ♂; ♀ unknown. Very rare near Rock Island, Ill. A search of several weeks for the ♀ of this species, and also for additional ♂ specimens, was finally unsuccessful.

A new species of *Hetærina*, *basalis* Hagen, is briefly described by its differences from *americana* in M. Selys's *Addit. Synops. Calopt.* p. 6. (where however the habitat should be "Pecos River, Texas," instead of "Pecos River, High California,") and also in Hagen's *Synopsis* p. 60. As in that species the basal spot is said to extend $\frac{4}{5}$ of the way to the nodus instead of only $\frac{1}{2}$ the way as in *americana*, it might be thought that our insect, whose basal spot extends about $\frac{3}{4}$ the way to the nodus, should be referred there. But, 1st, in *basalis* the basal spot is said to be more convex exteriorly than in *americana*, which is not the case here, and 2nd, the superior ♂ abdominal appendages of *basalis* are said to have the middle tooth "triangular," whereas according to the figure and description in the *Monographie* the middle tooth in *americana* is "rounded" in a regular curve, as in my ♂. Amongst the *débris* of a number of specimens of *Hetærina* sent me by Mr. Uhler, some of which were labelled "*basalis* Hagen, Texas," I find an abdomen with just such a triangular tooth on the ♂ abdominal appendage. In a word, this character of the tooth is structural and therefore as a general rule more important; the characters drawn from the spot are merely colorational, and are not, therefore, as a general rule, either so reliable or so important.

But besides this last distinction it is important to observe, that

throughout Odonata the ♂ abdominal appendages are most remarkably constant; and it is expressly remarked of the genus *Heterina* in the *Monographie* that "the species resemble one another greatly, so that many of them are distinguishable with difficulty, especially ♀ ♀," and that in ♂, besides the characters drawn from the wings, "we should pay special attention to the organization of the abdominal appendages, which are fortunately a little different almost in every species." (p. 87.) I have carefully collated 36 specimens of ♂ *rupumensis* n. sp. and can find no appreciable variation whatever in the structure of these organs. Hence we may infer, I think, that they are generally constant in other species of the genus, and as the characters in which our insect differs from *americana* are by no means constant, while that of the ♂ abdominal appendages, in which it agrees with *americana* and differs from *basalis*, may be assumed to be constant, we should place more dependance upon a single constant character than upon several inconstant ones.

The principle above referred to, which though not universally is, I think, pretty generally true, may be called the LAW OF EQUABLE VARIABILITY, and may be thus expressed:—If any given character is very variable in one species of a group, it will tend to be variable in allied species; and if any given character is perfectly constant in one species of a group, it will tend to be constant in allied species. For example, almost all the spotted *Coccinellidæ* are, as is well known, more or less variable in the characters drawn from their spots; *Anomala varians* Fabr. is exceedingly variable in its spottings, and so is *A. lucicola* Fabr. and *A. binotata* Schönh.; the European *Donacia Proteus* has the ground-color remarkably variable, and most of our N. A. species vary similarly more or less; *Orsodacna vittata* Say, is most remarkably variable in its vittæ, and so is another vittate species *O. childei* Kirby, from Hudson's Bay; the different species of *Melitæa* and *Argynnis* are notoriously variable in the markings of their wings; the spotted species of *Tettigoniidæ* are more or less variable in their spots and some astonishingly so; and throughout *Perlina* the neuration, which in most families of insects is constant, is more or less inconstant. On the other hand, in the allied family *Odonata* the neuration is wonderfully constant. Finally, in the tribes *Eschnina* and *Libellulina* the coloration is pretty constant; in the tribe *Agrionina* it is as incon-

stant.* All this is generally expressed by saying that so and so are difficult, variable or polymorphic groups; but I do not know that any one has yet called attention to the fact as a confirmatory proof of the Derivative Origin of species. Mr. Darwin certainly has not done so. The question seems unanswerable:—If species were separately created, not derived one from the other, why should variability have been largely conferred upon some entire groups and almost entirely denied to other entire groups? Why should the spotted Erotylidæ be constant, and the spotted Coccinelladæ inconstant, in their spottings?

Throughout Odonata, as is well known, the ♂ abdominal appendages are used to embrace the neck of the ♀ preparatory to and during copulation, and for that purpose they are in general curiously curved and in many cases, especially the two superiors, armed with teeth thorns or branches. The ♀ abdominal appendages are here, on the contrary, always simple—lamine, elongate-conical or cylindrical—and almost invariably smaller than those of ♂. In most genera of Locustariæ Latr. (=Gryllidæ Leach,) e. g. in Phylloptera, Orchelimum, Xiphidium and Conocephalus, but not in Rhaphidophora† which osculates

* In my Paper on *Ill. Pseudoneur.* (p. 381) I stated erroneously that the milky-blue tint (*bleu saupoudré*) often found on the bodies of certain mature ♂ Libellulina "seems to be secreted under the external integument, and what is known as *pruinoseness* in Agrionina on its surface, whence it may be washed off." In both tribes the bluish matter is secreted externally, and in both it may be easily washed off. Hence variability arising from this source can scarcely be considered as colorational variability, and so far as regards this character the tribe Libellulina are not variable in their coloration.

† The tetramerous Locustarian genus Rhaphidophora osculates through the partly trimerous allied genus Daihinia, Hald., and the partly tetramerous Gryllide genus Ecanthus, with the elsewhere uniformly trimerous Gryllides. Hence it is not surprising that the ♂ ♀ abdominal appendages should here be antenniform as in Gryllides. Rhaphidophora and its allies agree also with Gryllides, except Tridactylus, and differ from all other Locustariæ known to me, in the ♂ not having any inferior abdominal appendages. In Locustariæ, with the above exception, in Blattadæ, in Mantidæ, and in Acridii, the ♂ but not ♀ has two inferior appendages. In Blattadæ and Mantidæ these appendages are separated from each other, as in the tribe Agrionina, and antenniform, and are known as "anal styles." In the Locustarian genera Phylloptera, Orchelimum, Xiphidium and Conocephalus they are laminiform and soldered together more or less at base and antenniform at tip. Finally, in the Locustarian genera Cyrtophylus and Phaneroptera and in all Acridii, they are soldered together either

with Gryllides Latr. (= Achetadæ Leach,) in Phasmidæ (*Diapheromera femorata* Say) where however the inferior appendages are wanting, in the Neuropterous family Panorpina, and also in the subfamily Corydalides Westw., of the family Sialina, the ♂ appendages are similarly prehensile and the ♀ appendages similarly simple. Here, however, it is the abdomen and not the neck of ♀ that is grasped by ♂, Odonata being the only known family where the true ♂ reproductive organs are placed at the base, instead of at the tip of the abdomen, and their *coitus* being consequently abnormal. In Forficuladæ the superior

basally or throughout, as in the Tribes *Æschnina* and *Libellulina*, and laminiform throughout. In the two latter cases the lamina is known to Orthopterists as "the infra-anal plate," (*squama subanalis*, Saussure.) On the other hand, in the Perlinoous genus *Acroncuria* the ♀ has a pair of small, triangular, inferior appendages, and the ♂ has none; while throughout Ephemerina, where the superior appendages are similarly antenniform ♂ ♀, the two inferior appendages are multiarticulate and sexually prehensile ♂, but absent ♀.

Typically, the superior abdominal appendages are, I think, three in number. In Ephemerina they are all, when present, antenniform, and there is a regular gradation from groups where they are equal in length ♂ ♀ (*Ephemerella*, Walsh,) through groups where they are subequal ♂ ♀ (*Ephemerina*,) and others where they are subequal ♀ but the middle one short ♂ (*Pentagenia*, Walsh,) and others again where the middle appendage is short or subobsolete ♂ ♀ and either articulate (*Bætis* ♂♂ A & B, Walsh) or exarticulate (*Bætica*, Walsh,) to groups where the middle appendage is entirely obsolete, (*Bætis* ♂ C. Walsh.) In Odonata the middle appendage is obsolete ♂, but is represented ♀ by a laminiform piece known as the superior anal process and most distinctly seen in Gomphina, the two inferior anal processes representing the inferior ♂ appendages. In the Odonatous pupa, however, they are all three present, in the pupa of Gomphus and Agrion all three alike, and in that of Agrion long and subequal. Throughout Orthoptera, except Forficuladæ where it is obsolete, the middle appendage is represented by what Orthopterists call the supra-anal plate, and in several Acridians the three superior appendages are almost exactly alike, viz., triangularly laminiform. That this supra-anal plate is not the terminal dorsal joint of the abdomen is proved by the fact, that in Mantidæ and Phasmidæ it exists, though small in size, in addition to the nine typical abdominal joints which are all dorsally present in these two families. In most Neuropterous and Pseudoneuropterous families the middle superior appendage is obsolete or subobsolete ♂ ♀. In *Corydalus* e.g. it is represented by an indistinct triangular lamina. The Locustarian genera *Phaneroptera* and *Cyrtophyllus* are remarkable for the intermediate appendage being greatly and narrowly prolonged ♂ and in the former genus bifurcate at tip, and in conjunction with the similarly prolonged "infra-anal plate," which consists of the two inferior appendages soldered together, forming a vertical, prehensile, sexual

appendages are forcipate but nearly alike ♂ ♀ and are used as defensive weapons, the two inferiors being absent. In all the other Neuropterous, Pseudoneuropterous and Orthopterous families, excepting, so far as regards the inferior appendages, the family Ephemera, the abdominal appendages when present are simple, and when present in both sexes are alike ♂ ♀. Occasionally they are laminate (Acridii Latr.=Locustadæ Leach) but usually more or less setiform, the superiors often very long and antenniform and either exarticulate (Gryllides) or multiarticulate. (Blattadæ, Mantidæ, Perlina, Ephemera.) Hence morphologically they must, I think, be considered as caudal antennæ, as they have been actually observed in Gryllides, where however the two inferiors except in Tridactylus are absent, "to be very sensible and to serve probably to give the animal notice of the approach of any annoyance from behind." (Westw. Intr. I. p. 441.) Functionally, however, though not morphologically, these organs are in Odonata and the above enumerated Orthopterous and Neuropterous groups, in ♂ but not in ♀, accessory reproductive organs, just as in Forficuladæ ♂ ♀ they are functionally weapons of defense. The true ♂ reproductive organs are generally in the class Insecta small, retractile and more or less fleshy, so as to be studied with difficulty, especially in the dried specimen, except in Odonata and a few other families, where they are generally large, exerted and horny and consequently not liable to lose their form in drying. Wherever they have been studied, however, they seem to follow the same laws as the ♂ reproductive organs of Odonata, whether true or accessory, which have been so elaborately illustrated by Dr. Hagen, viz., that they are remarkably constant in the same species, and that they differ by small but constant differences in the ♂ ♂, but scarcely

forceps. Consequently, as this forceps takes the place of the normal horizontal ♂ forceps formed by the two exterior appendages, the latter are here nearly alike in ♂ ♀, except that in Cyrtophyllus they have a long branch ♂ which does not appear ♀.

That the long exarticulate seta in Gryllides is strictly homologous with the short prehensile superior appendage found in ♂ Odonata, &c., is proved by the fact, that the *larva* of Chauliodes, as will be hereafter shown, has two long superior setiform appendages almost exactly like those of Gryllus (=Acheta,) while the *imago* of ♂ Chauliodes has a pair of short prehensile superior appendages closely resembling those of the Odonatous Erpetogomphus. Nobody, I believe, has doubted that the exarticulate seta in Gryllides is homologous with the multiarticulate seta of Ephemera and Perlina.

differ in ♀ ♀, of allied species.† On the other hand it is notorious that when in Neuroptera, Pseudoneuroptera and Orthoptera the ♂ abdominal appendages are normal, i. e. antenniform, or degraded so as to be functionally useless, (Acridii,) there is scarcely any difference in their structure between allied species of the same genus or even of the same family.

These facts lead me to suspect that generally in the Class Insecta, when a variation useful to ♂ in his sexual operations does take place in ♂ reproductive organs, it is often seized hold of by Natural Selection to originate a new species, the less favored ♂ ♂ being beaten in the struggle for ♀ ♀; and that species thus formed afterwards, by ordinary variation and by so to speak "breeding in-and-in," modify and gradually exaggerate colorational peculiarities which were originally common to them and the supposed primordial form from which they sprang. In no other way, on the Principles of Natural Selection, can I account for the well-known fact of the colorational design or pattern being so often the same throughout a large group of species, though it generally differs minutely in each of these species in its proportions and details; while in the same group we shall find scarcely any structural differences, which could have been seized hold of by Natural Selection to originate new species, unless it be in the ♂ reproductive organs. In *Heterina*, for example, there are normally three dark stripes on the pleura of the thorax, two on what I consider to be the mesothoracic epimerum, and one on the metathoracic episternum. Again, in *Gomphus* there are normally two dark stripes on the pleura, one on the mesothoracic epimerum and one on the metathoracic episternum. Thirdly, in *Gomphus* Messrs. Selys and Hagen have shown, that there are normally three dark stripes on each side of the dorsum of the thorax, or what I conceive to be the mesothoracic episternum. Fourthly, in *Agrion* and *Lestes* I have shown that there are normally three dark vittæ on the femur, (*Ill. Pseudoneur.* pp. 282-3,) and

† E. g. in the hymenopterous *Bombus*, as observed by Audouin, quoted *Westw. Intr.* II. 281; in the dipterous *Limnobina*, as observed by Osten Sacken. See Plates and descriptions of Plates appended to his Paper on *Limnobina* in *Proc. Phil. Acad. Sc.*, Aug. 1859. I have myself observed the same thing in *Locustaria* Latr. of the superior ♂ abdominal appendages or accessory reproductive organs.

the "posterior" series of subobsolete dark spots which I have since observed in several species of *Heterina* seems to indicate that there is normally also a fourth dark vitta there—the posterior one. Yet in all these groups there are scarcely any structural specific characters but those which are drawn from the reproductive organs. Now what possible advantage can it be to a ♂ *Heterina* or to a ♂ *Gomphus* or to a ♂ *Agrion*, to have the colorational stripes on any part of its body arranged a little differently, or a little wider or narrower, or one or more of them confluent, abbreviated, interrupted, subobsolete or obsolete? On the principles of Sexual Selection, we can readily and naturally account for ♂ ♂ being often more highly colored or more highly ornamented than ♀ ♀, but it is unconceivable to me that such minute differences as those above referred to could be appreciated by ♀ ♀. Neither can I understand how such minute differences as these could be of any use to the whole species, both ♂ ♂ and ♀ ♀, so as to be seized on, not by Sexual Selection, but by Natural Selection. Darwin has felicitously conjectured, with regard more especially to Vertebrates and Plants, that "the most frequent cause of variability may be attributed to ♂ ♀ reproductive elements having been [functionally] affected prior to the act of conception." (*Orig. Spec.* p. 15.) The affections above spoken of are structural, not functional; but it is not improbable that they may similarly give rise to a considerable amount of variation in coloration and perhaps occasionally even in structure. Prof. Owen has observed that "the generative organs, being those which are most remotely related to the habits and food of an animal, have been always regarded by him as affording very clear indications of its true affinities." (Quoted *Or. Spec.* p. 361.) It is remarkable that in Odonata, although the form of the ♂ reproductive organs differs almost in every species, yet that there is a certain family likeness throughout many, perhaps most, of the groups. No Neuropterist, for instance, could possibly mistake the ♂ abdominal appendages of any species of *Agrion* for those of a *Lestes*, or those of a *Lestes* for those of a *Heterina*. I select the above examples because here the classification is not, as in the subgenera of the genus *Gomphus*, based upon the structure of the ♂ abdominal appendages; and it cannot therefore be contended that I am arguing in a circle and saying that certain species belong to a separate group because their ♂ abdominal appendages have a general resem-

blance, and that the ♂ abdominal appendages have a general resemblance because they belong to that group.

If the above hypothesis, viz. that species often originate from structural variations in their ♂ reproductive systems, be correct, we can gain some glimpses of light upon the extraordinary and anomalous phenomena of hybridism. We can see dimly why species of distinct families never cross; why distinct species of the same family do not commonly cross in a state of nature; why varieties generally but not always cross with facility; why species apparently closely allied should sometimes cross with difficulty or not at all, and others apparently wide apart in a natural system should sometimes cross with facility; why certain genera of plants should be fertilized more readily by the pollen of distinct species than by their own; and why the ♂ of a given species should cross readily with the ♀ of another species, and the ♂ of that other species cross with extreme difficulty or not at all with the ♀ of the first. The fact that, with the imperfect resources at our disposal, we cannot detect in very many cases such structural variations in ♂ reproductive organs, does not prove their non-existence. No chemist has yet succeeded in detecting any peculiar substance in the air of malarial districts;* yet that there is such a thing as malarial matter in the air, it is almost impossible to disbelieve.

With regard to the question whether *H. basalis* Hagen, be a mere geographical race of *H. americana* Fabr., as hinted by Selys and Hagen, I incline upon the above principles to the opinion that they are distinct species, if it were only on account of the different structure of their ♂ abdominal appendages. It may be assumed, it is true, that intermediate grades between the two structures exist in the country intermediate between the habitats of the two supposed species, as has been shown by Dr. Hagen to be the case in Gomphina with the European *Onychogomphus forcipatus* and *Cordulegaster annulatus*; but until this is proved with regard to some one Calopteryginous species, the assumption is a very unsafe one. A character which is notoriously constant throughout a large group in specimens of any given species from the same locality, cannot, I think, without some collateral proof be reasonably assumed to vary in specimens of another species belonging to the same group from different localities.

* *Consolations in Travel*, by Sir Humphrey Davy, p. 116.

The only valid practical criterion of specific distinctness is the general non-existence, either actually ascertained or analogically inferred, of intermediate grades in the distinctive characters, whence we may reasonably conclude that the two supposed species are distinct, i. e. that they do not now in general mix sexually together, or if geographically separated that they would not do so supposing them to be placed in juxtaposition. Whether they are descended from common parents which ages and ages ago mixed sexually together, is another and a very different question, which concerns the speculative philosopher not the practical naturalist. They may even now mix sexually together in some few rare instances, as I have recorded to be the case with *Coccinella abdominalis* Say, and *Chilocorus bivulnerus* Muls.; (Proc. Ent. Soc. Phil. I, p. 351,) and yet if they do not commonly and habitually mix together the species will remain distinct. Hence all experiments on artificial hybridization seem to me to prove nothing as to the distinctness of species, unless they are conducted, as they necessarily cannot be, on the same gigantic scale as that upon which Nature works. We may and do mix the horse and the ass and produce a mule or a hinny, but what naturalist believes that if a herd of wild asses were transported to the plains of Mexico they would mix habitually with the mustangs and produce all the intermediate grades? Every field-entomologist is aware of the fact that 5 or 6 very closely allied species, e. g. of *Cicindela*, will often be found on a piece of ground 100 yards square, and yet that every one of them keeps perfectly distinct. A similar case occurs in the genus *Gomphus*, of which 10 perfectly distinct but closely-allied species co-exist in the neighborhood of Rock Island, Ill., three of which, as already recorded, (Ill. Pseudon. p. 396.) I have seen coming out of the water together in the pupa state on one and the same day, and on one and the same spot of ground. Immediately that we assume any other criterion of specific distinctness than the general non-existence in a state of nature of the intermediate grades, either proved by actually examining numerous specimens or inferred from the analogy of allied species, all is chaos and confusion. The formerly received dogma that hybrids are incapable of further propagation, has been proved by Rev. W. Herbert and others to be utterly false in the Vegetable Kingdom, and is probably false in the Animal Kingdom. Hence may be seen the importance of describing species.

whenever practicable, from numerous specimens, and carefully noting all the variations; for to describe the species is often a very different thing from describing the individual. Hence, too, we may see the reason why descriptions are necessary even when the very best colored figures are given; for a single figure necessarily gives only the individual, perhaps an average of the species, perhaps an extreme variety, but a good description gives the variations as well, and consequently the species. In variable genera, such for instance as the coleopterous *Haltica*, *Chrysomela*, *Cryptocephalus*, and their allies, almost any entomologist not familiar with the Order, would suppose individual specimens taken from the two extremes of a specific series to be specifically distinct, and it is only the existence of the intermediate grades which proves them to be identical. In one word, the *amount* of difference between two supposed species is comparatively nothing, the *constancy* of the difference is comparatively everything.

I am not ignorant of the existence in the Vegetable Kingdom of what are called Dimorphous species, where hermaphrodite flowers of two distinct types of structure, without any intermediate grades, occur on separate plants of what is undoubtedly the same species. (See *Silliman's Journal* xxxvi. p. 279.) Something similar to this has been long known in the Animal Kingdom, in the case of the females and so-called neuters of social insects. The queen-bee actually differs from the common working-bee in several important structural characters; and hymenopterists do not hesitate to separate, as specifically or even generically distinct, forms which differ in no greater degree than do these two forms, which undoubtedly belong to the same sex of the same species. It may be said that the differences between the queen-bee and the working-bee arise from differences in food, &c., or what naturalists call "the Conditions of Life." Granted. But who will undertake to assert without a particle of proof that if the food, &c. were of an intermediate character, an intermediate form between the queen and the working-bee would be produced? It would be as reasonable for some chemical dogmatist to assert without a particle of proof, that because certain chemical substances are known to exist in what are called "allotropic states," therefore the intermediate states can be called into being. Again, what is known as "gynandromorphism" in the Coleopterous *Dytiscus* and in Lepidoptera in *Papilio Turnus* and in certain

species of *Colias*, (See *Proc. Ent. Soc. Phil. I.* p. 349-51,) is nothing but a phase of Dimorphism; and the orange-colored ♀♀ of *Agrion Ramburii* are perhaps referable to the same class of facts, for I do not remember ever to have seen any intermediate grade between the blue ♀ and the orange-colored ♀. Thirdly, in the coleopterous genus *Siagonium* and its allies, where the ♂ head is armed with horns, we are told by Westwood that "these cornuted individuals appear to be of two distinct kinds," some with large and some with small horns, and that "out of 50 ♂♂ of *Siagonium* he was not able to find a single individual intermediate between the two kinds"; (*Introd. I.* p. 172,) which is a clear case of ♂ dimorphism. Fourthly, it has long been known that certain species of Orthoptera, Hymenoptera and especially of Heteroptera and Homoptera sometimes occur in the ♂♀ imago state with very short wings and sometimes with long ones, without any intermediate grades, and that other species are in the ♂ imago sometimes fully winged but generally apterous, without any intermediate grades, an instance of which, in the Ichneumonide genus *Pezomachus*, I have recorded in my *Essay on Insects injurious to Vegetation in Illinois* (p. 369.) Fifthly, in Cynipidæ I have some very strong proof, which at some future time I shall offer to the world, that Hartig's agamous species, which exist only in ♀ sex, are mere dimorphous forms of bisexual species.* In the Vegetable Kingdom it appears that there are even trimorphous species, and similarly in Formicidæ the genus *Atta*, a species of which commonly occurs in Illinois, has one kind of neuters with heads of the ordinary proportions, and another kind with heads as bulky as the remaining part of their bodies, with no intermediate grades whatever, as I have repeatedly observed. A phenomenon apparently of the same kind occurs in *Termes*, but as in *Pseudoneuroptera* the larva and pupa resemble the imago and are active, and as the so-called "nasuti" may possibly be larvæ, the case is not so strong a one. It has often been said that there are also two distinct sizes of neuters belonging to the hymenopterous genus *Formica*, but my experience is that here all the intermediate sizes coexist in the same

* See on this subject Baron Osten Sacken's *Papers on N. A. Cynipidæ*, *Proc. Ent. Soc. Phil. I.* pp. 49-50 and 248-249. Brullé dismisses this physiologically important and very remarkable subject in a dozen lines. *Suites a Buffon. Hymenopt.* IV. p. 632.

nest. Lastly, it is well known that there are three distinct types of the Lepidopterous *Vanessa interrogationis*, which were "all obtained from the same caterpillars" by Boisduval & Leconte. (Quoted by Mr. Edwards, *Proc. Ent. Soc. Phil. I*, p. 184.)—In the meantime, the general non-existence of intermediate grades between two closely-allied forms may and must be taken as *prima facie* evidence of their specific distinctness. That "the exception proves the rule" is an old and not very philosophical saying; but that there are exceptions to almost all rules in Natural History is undoubtedly true. Monomorphism is the rule; Dimorphism is the exception.

It may be observed here that in many, though by no means in all, Odonatous groups there is a great overplus of ♂♂. In the same way Mr. Edwards has remarked to me that in the genus *Papilio* the ♂♂ are about four times as numerous as ♀♀, and I can confirm the fact from my own observation. I shall afterwards prove that this is also the case in a subgroup of the subgenus *Gomphus*. In the two subgenera of *Heterina* (*Lais* and *Heterina*) it appears to be almost the universal rule. Of the 37 described species of these two closely-allied subgenera, although collectors of course always strive to make up pairs of each species, the number of ♂ specimens known to exist is about 366, and the number of ♀ specimens known to exist only about 90, calculating from my own species and from those where the numbers of ♂♀ specimens are given in the *Monographie*; and in no less than 6 species of the 37 the ♂ only is known. Hence we may conclude that generally in the genus *Heterina* the ♂♂ are at least 4 times as numerous as ♀♀. This great preponderance of ♂♂, wherever it exists, must give much greater latitude to the above-mentioned kind of "natural selection," than if the sexes were equal in number or ♀♀ more numerous than ♂♂.

H. pseudamericana n. sp. ♂. Brassy-black. Top of the head, including the orbits of the eyes, coppery-red, occasionally greenish-brassy. Epistoma generally greenish-brassy, sometimes coppery-red when the top of the head is also so, always with a lateral whitish spot; rhinarium blackish; labrum very pale dull brown, with a large, shining, basal, black spot in the middle; labium and its lobes brownish white; mandibles whitish on their basal $\frac{1}{2}$, shining black on their terminal $\frac{1}{2}$. Back of the head blackish; postoccipital tubercles obtuse. Antennæ black, the 2nd joint whitish at base and tip, sometimes entirely whitish except a small medial black spot. *Prothorax* dull coppery-red. Dorsum of *thorax* coppery-red, the dorsal carina black and generally crowned by a faint longitudi-

nal whitish line; immediately in front of the humeral suture a whitish line extending from its middle to the prothorax. Pleura whitish with a short black line above in the humeral suture and in each of the two sutures before and behind the spiracle, and a large black spot below in the segment before the spiracle which is black. The segment before the spiracle with a broad coppery-red stripe covering nearly its whole surface and touching the upper $\frac{1}{2}$ of the suture before the spiracle; the spiracle-bearing segment with a much narrower stripe, extending from the spiracle, where it is pointed, nearly to the origin of the wings; and the segment behind the spiracle with a still narrower stripe slightly abbreviated above and below. Antealar sinus generally dark-green, sometimes coppery-red. Sternum whitish. *Abdomen* with a narrow, basal, whitish annulus, interrupted above, on joints 3—7, and occasionally with a faint dorsal whitish line on 2—4; its sides indistinctly whitish. On the terminal $\frac{1}{2}$ of 10 is a carina, tipped with a minute slender thorn. Venter black, pale brown at base and tip. *Superior abdominal appendages* forcipate, about $1\frac{1}{2}$ times as long as the 10th abdominal joint, regularly curved inwards but not at all downwards on their upper edge, obtuse at tip, and when viewed in profile expanded downwards in a regular curve on their terminal $\frac{1}{2}$, blackish towards their tip, rather pale brown at their base, their exterior edge above except at the extreme base and tip with minute teeth directed obliquely backwards. On the middle of their inferior surface is a large laminiform tooth about 1.5th as long as the appendage itself, with its sides nearly parallel and its tip obtusely convex, directed downwards and inwards and a little forwards; and behind that again is a small round tubercle, beneath which a narrow laminiform prolongation of the large laminiform tooth sweeps round and then extends, directed inwards and downwards, to the extreme tip of the appendage. On the upper surface of the appendage is a carina, curved inwards at its base where it terminates in a tubercle, and behind the large laminiform tooth turning inwards and then assuming a narrow laminate form and running with its edge parallel to that of the narrow prolongation of the laminiform tooth to the tip of the appendage, so that the two together form a spoon-shaped cavity. Above, on the posterior base of the large laminiform tooth is a small indistinct tubercle. *Inferior appendages* just attaining the large laminiform tooth of the superiors, pale brown at base, blackish at tip, suddenly tapered near their base, thence cylindrical and terminating obtusely with a very robust short thorn or angle at their extreme tip directed inwards and upwards. *Legs* blackish; coxæ and trochanters whitish; femora "posteriorly" whitish on their basal $\frac{1}{2}$ with a "posterior" longitudinal row of blackish dots, and "posteriorly" at their extreme tips whitish immaculate, the intervening space blackish; tibiæ "superiorly" whitish except at tip. *Wings* hyaline; front wings with a carmine-red basal spot extending along the post-costal margin beyond the point opposite the tip of the quadrilateral, thence curving round the tip of the quadrilateral with an evanescent outline at a distance of 4—6 cellules from it to the median sector, thence following that sector to the arc, thence following the submedian vein to the base of the wing. Commencing at the base of the wing 1—6 of the first series of antecubitals, and 5—11 of the second series, and also 1—6 of the areolets of the basal area, are

centrally brown, those next the base of the wing the most so. The basal spot on the hind wings is brown towards the costa, sometimes with a fine purple reflection, carmine-red towards the postcosta with the areolets centrally brown and occasionally entirely brown. It almost attains the postcostal margin to beyond the tip of the quadrilateral, then leaving the postcostal margin at a distance of $\frac{1}{2}$ —2 areolets curves round the tip of the quadrilateral at the distance of 4—8 areolets, and proceeds to the costa, its general direction perpendicular to the costa, but with a bidentate outline, the second and by far the larger of the two teeth being on the median vein; thence follows the costa to the base of the wing. Veins and cross-veins above black in both wings, except those covered by the spots which are carmine-red and the basal $\frac{1}{2}$ of the median vein which is rufous. Beneath in both wings the basal $\frac{1}{2}$ of the median vein is rufous, and the basal $\frac{1}{4}$ — $\frac{2}{3}$ of the subcostal vein, the lower $\frac{2}{3}$ of the nodus, the origin of the nodal sector, and very conspicuously the entire length of the principal sector, are all yellowish white; as are also in the hind wing the veins and cross-veins covered by the basal spot, those covered by the basal spot in the front wing being carmine-red as above; the other veins and cross-veins black. The tips of all 4 wings immaculate. Pterostigma yellowish-white, $1\frac{1}{2}$ —2 $\frac{1}{2}$ times as long as wide and surmounting 1—1 $\frac{1}{2}$ cellules. Antecubitals 20—24; postcubitals 22—23. Cross-veins of basal area (front wing) 5—8; of quadrilateral (front wing) 7—10.

The ♀ differs as follows:—1st. The top of the head and the dark parts of the thoracic dorsum and pleura are bright green, except in a specimen from Mr. Uhler, where the two latter are coppery-red as in ♂. 2nd. The sides of the epistoma are widely bordered with whitish. 3rd. The second joint of the antennæ is always whitish, with a medial fuscous dot sometimes subobsolete. 4th. The prothorax is very dark green, narrowly bordered all round with whitish, and with a small, transversely double, dorsal, whitish spot immediately before its posterior lobe. 5th. The dorsal carina is scarcely black, but of the same color as the thorax only of a much darker shade, and in one specimen it is crowned by a whitish line as it generally is in ♂. 6th. The whitish annulus on abdominal joints 3—7 is wider and is not interrupted above except on 7, and there is a distinct whitish dorsal line throughout 1—10, only interrupted by the terminal short, black, annular subsegment of each segment. The sides of 1—10 are distinctly whitish with an irregular fuscous spot towards the tip of 1—7, and the dorsal carina extends the whole length of joint 10. 7th. The femora are whitish, the anterior ones with a confluent "anterior" and "superior" vitta, and the 4 others with only a "superior" vitta, both black; "posteriorly" all the 6 femora are marked as in ♂, the dots sometimes subobsolete. 8th. Instead of the basal spots, all 4 wings are pale-yellowish brown on their basal $\frac{1}{2}$ or $\frac{2}{3}$ with an evanescent outline, the extreme edge of the postcosta and the two ranks of antecubitals less obviously colored. In one Illinois specimen and also in that from Mr. Uhler, the veins and cross-veins covered by the pale yellowish-brown color are also pale yellowish brown above and below, except in the hind wing below where most of them are yellowish-white in all 3 specimens. Beneath in all 4 wings nearly the entire subcostal, instead of its basal $\frac{1}{2}$ — $\frac{2}{3}$, is

yellowish-white, and the lower $\frac{3}{4}$ of the nodus, the origin of the nodal sector and very conspicuously the entire length of the principal sector are yellowish-white, as in ♂. All the other veins above and below black. Pterostigma yellowish-white, 2—2½ times as long as wide and surmounting 1½—2 cellules. Antecubitals 20—24; postcubitals 19—23. Cross-veins of basal area (front wing) 6—9; of quadrilateral (front wing) 7—11. The abdominal appendages ♀ are 3-5th as long as joint 10, robust, conical, yellowish, with their tips excurved and their extreme tips blackish.

Length ♂ 45—46 mill. ♀ 38½—43 mill. Expanse ♂ 57—58 mill. ♀ 58—64 mill. Abd. ♂ 34½—38 mill. ♀ 30—34 mill. Front wing ♂ 30 mill. ♀ 30—32 mill. Hind wing ♂ 28½—29 mill. ♀ 28½—30 mill.

Three ♂, three ♀; rare. One ♀ was sent me by Mr. Uhler as ♀ of *americana*; the other ♂ ♂ ♀ occurred on Rock River, Illinois, from the beginning of July to the end of August; one ♂ and one ♀ very mature. Although none were taken *in coitu*, yet the very remarkable and conspicuous whitishness of the principal sector on its inferior but not on its superior surface, no traces of which are met with in ♂ *americana*, sufficiently proves that this ♀ does not belong there; and as only three ♂ forms occurred on Rock River during a careful search of many weeks, viz. *americana*,* *rupamnensis* and *pseudamericana*, and the ♀ of *rupamnensis* is known with certainty, this ♀ may be confidently correlated with ♂ *pseudamericana*. Differs from all described *Hetærina* but *texana* n. sp. in the whitishness of the principal sector beneath. In *pseudamericana* the basal spot of the ♂ front wing is particolored; in *americana* and *basalis* it is unicolored. In *pseudamericana* the carmine-red part of the basal spot in the ♂ front wing does not extend so far forwards even as the basal area; in *americana* and *basalis* the carmine-red basal spot of the front wing extends to the costal edge, basally in the former, nearly for its whole length in the latter. This species differs also from *americana* and *basalis* in the pterostigma of both the mature and the immature ♂ being yellowish-white. The superior ♂ appendages scarcely differ from those of *americana* Fabr., Walsh,* except in the laminiform tooth being much larger and the tubercle behind it smaller, and in the tubercle on the superior base of the laminiform tooth being smaller and more indistinct.

The *Monographie* (p. 97) lays it down as one of the characters of the subgenus *Hetærina*, that in the front wing of ♂ "the postcostal area

* For *americana* read *scelerata* n. sp. See Appendix.

is filled with small irregular areolets," while in the front wing ♀ and in the hind wing ♂ ♀ it "has two regular ranks of areolets." Subsequently on p. 281 it is observed that in *H. Brightwelli* it is only the hind wings ♂ ♀ that have the two regular ranks of areolets, the front wing of ♀ having three. In *pseudamericana* ♀ the front wing has 3—5 very irregular ranks; in *texana*? ♀ n. sp. 2—3. Again, I observe that in the hind wing both of my specimen and of the Uhlerian specimen of *americana* ♂ there are 3—4 irregular ranks of areolets, and that there are 2—3 in the hind wing of two out of three *pseudamericana* ♂, as is also the case in *rupinsulensis* ♂ Walsh, and in 4 or 5 specimens out of 36 of *rupamensis* ♂ n. sp. Hence the characters of the subgenus *Hetærina* must be modified, so as to assert simply that in the front wing ♂ the postcostal area is filled with small irregular areolets, which is sufficient to distinguish that subgenus from the subgenus *Lais*, where "the postcostal space of all 4 wings ♂ ♀ up to opposite the tip of the quadrilateral has two regular ranks of large areolets," (Monogr. p. 87.) in connection with the fact that the wings of ♂ *Lais* have no basal red or brown spot, and those of ♂ *Hetærina* always have such a spot.

H. texana n. sp.

♂. Differs from the preceding ♂ only as follows:—*1st.* The back of the head is green not blackish. *2nd.* The large laminiiform medial tooth on the superior appendage, instead of being convex at tip, is distinctly emarginate so as to appear bilobate, the anterior lobe the more prominent; and the tubercle on its superior surface is distinct. *3rd.* The median vein in both wings above and below is scarcely rufous on its basal $\frac{1}{2}$ but rather carmine-red. *4th.* The basal spot on the hind wing is less brown and more carmine-red; it attains the postcostal margin for $\frac{1}{2}$ its length and nearly attains it the rest of its length, and its outline towards the tip of the wing is almost straight instead of being conspicuously bidentate. *5th.* Only in one wing is there a pterostigma, and there it is no longer than broad and represented only by two thickened cross-veins with the intervening space hyaline; in the other 3 wings it is represented merely by a single thickened cross-vein. Antecubitals 21. Postcubitals 20—21. Cross-veins of 4 basal areas 6—8; of 4 quadrilaterals 7—10. Length ♂ 48 mill. Abd. ♂ 37 mill. Expanse ♂ 62 mill. Front wing ♂ 31 mill. Hind wing ♂ 29 mill. One

♂, the head and some legs lost, received from Mr. Uhler and labelled by him as "*H. basalis* Hagen, Pecos River, Texas." The coloration of the wing-veins and especially the whitishness of the principal sector below, the much smaller extent and different shape of the basal wing-spots, the presence of brown in the basal spot of the front wing, and the shape of the laminiform medial tooth on ♂ abdominal appendages, all prove that it cannot be *basalis* Hagen. But for the remarkable difference in ♂ abdominal appendages, I should suppose it to be a geographical race of *pseudamericana*, although none of my 6 specimens of that species show any disposition towards irregularity in the pterostigma. In *H. occisa* and *majuscula*, which belong respectively to the last but three and last sub-groups of the Table, (p. 210,) there is the same occasional absence of the pterostigma, and when absent it is represented, just as in our insect, by a single thickened cross-vein. It will shortly be seen that in *rupamensis* n. sp. the pterostigma is occasionally rudimentary as in the two foreign species just referred to, and occasionally has an additional cross-vein, equally robust with its bounding veins, as in certain specimens of the African *Phaon iridipennis* Burm.

♀? Unfortunately there is no full description extant of the ♀ of *americana*. In the *Monographie* Say's brief description is copied, and the words "head with a yellow abbreviated line on the anterior orbits" are translated "tête avec une bande jaune antérieure interrompue." (head with an interrupted anterior yellow-band,) whence the locality of the interrupted band becomes obscure. I have a mutilated ♀ *Heterina* sent me by Mr. Uhler, in which this short yellow line on the anterior part of the orbit of each eye is very distinct, and is about a millimetre long and placed just under the origin of the mandibles. This specimen agrees in most respects with Say's description of ♀ *americana*, but is remarkable for the following peculiarities:—1st. The wings are unusually narrow, the front wing being 30 millimetres long and only 5 millimetres broad at the nodus, while in ♂ *americana* (from Mr. Uhler) the front wing is 29 millimetres long and 5½ millimetres broad at the nodus, and in the ♀ *pseudamericana* which has the narrowest wings the front wing is 29½ millimetres long and 5½ millimetres wide at the nodus. 2nd. The wings are colored as in the normal ♀ *pseudamericana*. 3rd. The pterostigma, which is white, is three times as long as wide, and three out of the four have a distinct cross-vein

equally robust with the bounding veins.—As the color of the wing-veins which lie outside the region of the basal spot is not a sexual character, (*Monogr.* p. 87,) and as in this ♀ the median vein and principal sector are pale beneath outside the basal spot, while in ♂ *americana* and *basalis* they are black, it can scarcely belong to either of these two species. The yellow line on the orbit of the eye, the irregularity of the pterostigma, and especially the narrowness of the wings and the comparatively small number of the ranks of postcostal areolet, forbid its being confounded with ♀ *pseudamericana*. Unless therefore it is referable to *texana*, the pterostigma of which is irregular also, though in a different way, it must be an undescribed species. The abdomen is lost except the first joint which has a yellowish dorsal line, but the legs prove that it belongs to the same subgroup as *americana*. In *texana* ♂ there is no short yellow line on the anterior orbit of the eye, as in our ♀, but this is described as a *sexual* peculiarity of ♀ *americana* by Say. The front wing, however, of ♂ *texana* is 31 millimetres long and 6 millimetres wide at the nodus, and in most described *Heterina* the ♀ wings are either of the same proportional width as ♂ wings, or, as in *simplex*, *auripennis*, *hebe*, *longipes*, *proxima* and *vulnerata* from $\frac{1}{15}$ to nearly $\frac{1}{8}$ wider. But, according to the measurements of the *Monographie*, the ♀ wings are proportionally narrower than the ♂ wings, in *moribunda* by $\frac{1}{15}$, in *cruentata* by $\frac{1}{8}$, and in *tricolor* by $\frac{1}{4}$. Supposing this doubtful ♀ to be identical with *texana*, the ♀ wings would be nearly $\frac{1}{8}$ narrower in proportion than ♂ wings. The postoccipital tubercles agree with those of *texana* ♂, but, unless my memory fails me, this doubtful ♀ was labelled "Pennsylvania," not Texas, by Mr. Uhler. It only differs from ♀ *pseudamericana*, besides the points already mentioned, in the epistoma being narrowly bordered in front, as well as widely at the sides, with whitish, in there being no transversely double whitish spot on the prothorax, and in the thorax and legs being more dominantly whitish. Antennæ except the two basal joints, both the anterior legs and abdominal joints 2—10 lost.* The *Monographie* (pp. 87, 109, 114, &c.) remarks on the great difficulty of correlating ♂ with ♀ in the subgenera *Lais* and *Heterina*. Hence it is very important that when ♂ ♀ are taken *in coitu* they should be carefully preserved. Antecubitals 18. Postcubitals 21—22. Cross-veins of 4 median areas 4—6; of 4 quadrilaterals 5—6.

* Respecting this doubtful ♀, see Appendix.

H. rupamensis n. sp. ♂ Black with a slight brassy tinge. *Head* with the epistoma, labrum, and the anterior edge of front brown, the labrum with a shining black basal spot in the middle; mandibles and the labium and its lobes pale brown, sometimes brown, all black at tip. Antennæ black, the second joint and the extreme base of the third varying from very pale brown to dark brown. Post-occipital tubercles conspicuous and thorn-like. *Dorsum of thorax* generally more or less tinged with coppery-red, occasionally with greenish-brassy, the dorsal carina always black. The humeral suture with a broad reddish-brown or dark-brown stripe, straddling the suture on its lower $\frac{1}{2}$ and placed entirely behind it on its upper $\frac{1}{2}$. Pleura pale yellowish brown, with a short black line above in each of the two sutures before and behind the spiracle; on the segment before the spiracle a black stripe abbreviated below and above; on the segment bearing the spiracle a narrower black stripe abbreviated above and scarcely attaining the spiracle below; and on the next segment a still narrower black stripe abbreviated both above and below. Occasionally the ground color of the pleura is much darker and the normal design indistinct. Origin of each wing reddish-brown. Sternum pale-brown, generally more or less pruinose. *Abdomen* slender, generally with an obscure, lateral, pale brown vitta on joints 1—2, and generally with traces of a pale basal annulus on four or five of the joints next the base; joint 10 carinate above on its terminal half with a minute acute tooth at the tip of the carina and another on each side of it. *Superior abdominal appendages* black, half as long again as joint 10, obtuse at tip, regularly curved inwards but not downwards, with a broad lamina beneath directed inwards and downwards, which, when viewed obliquely from above, is seen to be semiovally emarginate, to commence with an oblique truncation tipped with a small pencil of hairs at the extreme base of the appendage, and to terminate in a square truncation at $\frac{2}{3}$ the way to its tip, the tip of the lamina being as wide as any part of it. Behind its terminal truncation this lamina is continued very narrowly to the tip of the appendage and is directed downwards. The superior carina of the appendage commences from its base without any tubercle, and runs on its upper edge $\frac{2}{3}$ the way to its tip, when it is suddenly deflected inwards and then runs with its edge parallel with that of the narrow prolongation of the inferior lamina to the tip of the appendage, so that the two together form a shallow cavity inside its tip. Opposite the square truncation of the lamina are situated above 5 or 6 minute, acute, slender teeth, directed obliquely backwards. *Inferior appendages* extending to $\frac{1}{2}$ the length of the superiors, black, slender, cylindrical, with a basal enlargement, regularly curved upwards but not inwards, truncate at tip, and with a robust acute thorn directed upwards at the corner of the truncation. *Legs* black, trochanters and coxæ pale brown, often pruinose; tibiae "superiorly" brown-black ranging to rather pale brown, but never pale-reddish-brown or fawn-color. *Wings* hyaline; front wings with a carmine-red basal spot generally attaining the postcostal margin for $\frac{1}{2}$ of its own length, occasionally scarcely attaining it except at its extreme origin, thence leaving the postcostal margin at the distance of $\frac{1}{2}$ —2 areolets, thence curving round the tip of the quadrilateral at a distance of 0—2 areolets, thence following the median sector above

the quadrilateral to the arc, thence following the submedian vein to the base of the wing. Above this spot the whole basal area and the trapezium beyond the arc formed by the osculation of the principal sector with the median vein, and also one or two of the basal areolets in each series of antecubitals, are all brown. Hind wings with a basal brown spot never extending into the postcosta, but following the postcostal vein from its base to the tip of the median area, so as almost always to cover the whole length of the median area, thence proceeding so as almost always to leave the terminal $\frac{1}{2}$ of the quadrilateral hyaline, but occasionally covering the whole of that as well as the median area, thence starting from the upper side of the quadrilateral and extending in a more or less prolonged and obscurely defined tongue along the median vein towards the tip of the wing, thence more or less gradually nearing the costal margin and attaining it at or before the origin of the wing. In one wing of a single specimen the spot does not attain the tip either of the median area or of the quadrilateral by 5 areolets. Above in both wings and beneath in the front wing the veins and cross-veins covered by the spots, except those not far from its margin, are the same color as the spot, but in certain lights the cross-veins of the basal area on the under side of the front wing are milk-white. In the hind wing, both above and below, the cross-veins are sometimes lightly bordered with subhyaline. In the hind wing beneath most of the cross-veins and some of the veins covered by the spot are conspicuously milk-white. All the other veins and cross-veins in both wings, both above and below, black. Extreme tip of hind wings always more or less bordered with brown, and occasionally a trace of brown at the tip of the front wing. Pterostigma brown or pale-brown, variable in size, 1—2 times as long as wide, surmounting 1—2 cross-veins. In a single wing of two separate specimens it has a cross-vein as thick as its bounding veins; in a single wing of another it has a longitudinal vein in its middle;* in a single wing of still another it is hyaline in its middle; and in two wings of a fifth specimen it is rudimental and represented only by one thickened cross-vein. Antecubitals (12 specimens) 19—26; postcubitals (12 sp.) 25—35. Cross-veins of basal area (front wing of 12 sp.) 4—7; of quadrilateral (same) 4—8.

The ♀ differs as follows:—1st. The brown parts of the head are several shades paler, and the upper edge of the occiput is distinctly pale-brown, as well as the basal $\frac{1}{2}$ of the 3rd joint of the antennæ. 2nd. The prothorax is irregularly bordered with pale brown. 3rd. The dorsum of the thorax is very pale reddish-brown or fawn-color to a little beyond the humeral suture on the upper part of that suture, with the dorsal carina and a short line at the top of the humeral suture, black. On each side of the tip of the dorsal carina a longitudinally oval spot $\frac{1}{2}$ as long as the carina, and inside the humeral suture a lanceolate spot extending from the antealar sinus half-way to the prothorax, both bright grass-green. Pleura as in ♂ and with the same black lines above, but always

* This is analogous to the supernumerary short longitudinal vein, in the place where the pterostigma ought to be, found in three wings of a single specimen of *Q. H. cruentata* Ramb. (*Monogr. Calopt.* p. 129.)

of a pale yellowish brown color, and with the 3 stripes bright green instead of black, and the anterior stripes much more abbreviated above. Antecubital sinus with a small pale brown spot in the anterior angle. 4th. The abdomen is, as usual, shorter and stouter, and it is more tinged with brassy except when obscured by pruinescence; and there is a distinct, narrow, basal, whitish annulus, interrupted above, on joints 3—7. Joints 1—2 are laterally pale-reddish-brown, dorsally grass-green, joint 2 with the sides of the green spot very deeply emarginate in the middle. Joints 3—10 laterally marked with obscure pale brown, 10 carinate for its entire length, the carina tipped with a slender, acute thorn, beneath which is a pale tubercle, and having on each side of its tip a minute acute tooth. 5th. The femora, except towards the tip, are very pale-brown "inferiorly" and "posteriorly," the posterior brown surface with a longitudinal row of dusky dots. 6th. The wings are entirely immaculate, lightly and uniformly subflavescent, but rather more obviously so at the extreme base and occasionally along the costa. Veins and cross-veins all black. Pterostigma white, $1\frac{1}{2}$ — $2\frac{1}{2}$ times as long as wide and surmounting $1\frac{1}{2}$ — $1\frac{3}{4}$ cells. The abdominal appendages are $\frac{2}{3}$ as long as the last abdominal joint, robust, conical, excurved and tapered to an acute thorn at tip, black at tip and brown towards their base. Antecubitals 17—21. Postcubitals 22—28. Cross-veins of basal area (front wing) 4—5. Of quadrilateral (same) 3—5.

Length ♂ 46½—51 mill. ♀ 42—44 mill. Abd. ♂ 37½—41½ mill. ♀ 33—34 mill. Exp. ♂ 56—59 mill. ♀ 59—62 mill. Front wing ♂ 29—31½ mill. its width 6—6½ mill. ♀ 31—32 mill. its width 6½—6¾ mill. Hind wing ♂ 28—30 mill. its width 5½—6 mill. ♀ 30—31 mill. its width 6—6½ mill.

Thirty-six ♂, four ♀; three pairs taken *in coitu*. Occurred on Rock River, Ill., whence the trivial name, from the middle of August to the middle of September. Local and not very common. *Rupinsulensis* Walsh, occurred on a small rivulet emptying into the Mississippi River three miles from the nearest point on Rock River. *Rupamnensis* scarcely differs from that species except in the spot on the ♂ front wing being partly carmine-red, in that spot always extending much behind the postcostal vein, in the basal spot on ♂ hind wing being very much darker, and in the coloration of the femora. The ♂ abdominal appendages are undistinguishable, and I should have supposed *rupinsulensis* to be the immature form of *rupamnensis* but for the fact that my unique ♂ specimen of the former is decidedly mature, and that, although many of my 36 ♂ specimens of the latter are immature, yet none of them show any approximation whatever to the other species in the coloration of the basal spot of the front wing. The difference in locality is not so slight as might at first sight be supposed. I have observed that *Hetaerina* ♀ flirts her eggs into the open river, without attaching them to aquatic plants &c., as do certain other Odonata;

and consequently those eggs are not improbably carried down by the current from the upper waters of the river where they occur. Comes very near indeed to *tricolor* Burm., but differs 1st, in the ♂ antennæ being particolored not uniformly brown; 2nd, in having a distinct lateral green stripe on the dorsum of ♀ thorax, whereas ♀ *tricolor* is described as having none; 3rd, in the stripes of ♀ pleura being bright-green, not "brown"; 4th, in the abdomen ♂ being much slenderer than in *americana*, whereas in *tricolor* it is said to be "a little more robust than in *americana*"; 5th, in ♀ abdominal joints 1—2 being bright-green above, not "black;" 6th, in the inferior lamina of the ♂ abdominal appendages terminating in a square truncation the apex of which is scarcely rounded off, whereas in *tricolor* it is described as terminating in "an obtuse tooth." 7th, in there being no tubercle at the superior base of the ♂ appendage, as figured and described in *tricolor*; 8th, in the ♀ wings being within a minute fraction as broad in proportion as ♂ wings; whereas in *tricolor* the ♀ wings are described as $\frac{1}{4}$ narrower; and in some other minor points. *Limbata*, which is given provisionally as a variety of *tricolor*, is said to be much slenderer than *tricolor*, but it has the cross-veins of the inferior surface of the basal spots of ♂ wings "not in the least whitish," whereas they are conspicuously so on the hind wings of every one of my 36 ♂ *rupamensis*. From *moribunda* Hag. (S. A.) it is separated at once by that species having no distinct postoccipital tubercles, and from *titia* Drury (Mexico), by the wings of ♂ *titia* being "blackish-brown" outside the basal carmine-red spots.

The habits of the ♂ ♂ of this species are to traverse the water actively to and fro, and return from time to time to a favorite log or stick of wood lying in or overhanging the river. They are rather shy, but will come back repeatedly to their favorite station after being stricken at, unlike most of the larger Odonata. Their flight is strong and jerky, and resembles a good deal that of the lepidopterous genus *Vanessa*. The ♀ ♀ are comparatively sluggish, sometimes hiding in the weeds, and the ♂ ♂ must certainly be at least four times as numerous as ♀ ♀. *Americana*,* *pseudamericana* and *rupamensis* all occurred within two hundred yards of each other.

* For *americana* read *scelerata* n. sp. See Appendix.

Note 22, p. 179.—*LESTES EURINA* Say. There is a typical specimen of this species in the Harrisian Cabinet at Boston. My friend Mr. Scudder has kindly furnished me with the following description of it:—

"Greenish blue; mouth yellow; labrum luteous; top of the head and dorsum of thorax bright metallic blue with greenish and subviolaceous reflections, the dorsal and lateral sutures yellowish-brown, so as to show each a yellowish-brown inconspicuous LINE; sides of the thorax metallic blue, the sides of the mesothorax with a biserrate yellow spot occupying its lower posterior third; the side of the metathorax yellow with an oblique triangular fuscous stripe. Base of all the legs and under surface of the femora, especially of the posterior ones, yellow; upper surface of the femora, lower surface of the tibiae and tarsi brownish green; upper surface of the tibiae fuscous. Wings subhyaline or slightly flavescent; pterostigma black. Abdomen above with segments 1—5 blue, 6—10 blackish green; beneath pale fuscous, more dusky posteriorly, their apices blackish. Superior appendages forcipated, denticulate in the middle externally, beneath bidentate interiorly; the first tooth at the extremity of the basal fourth, sharply pointed and directed posteriorly, the second one just beyond the middle, flattened, (depressed,) laminate, minutely denticulate, directed towards the corresponding tooth in the other appendage. Inferior appendages removed. Postcubital cross-nervules 13 on one side, 15 on the other. Length to the base of the forceps 1 4-5 inch [46 mill.] Alar expanse 2½ inch [59 mill.] Pterostigma 1-10 inch [2½ mill.], surmounting 3—3½ cells, variable before and behind in either wing. One ♂."

On comparing the above with Say's description and with mine, I am fully satisfied of the identity of my insect with *eurina* Say. There is considerable variation in the coloring, but not more than we often meet with in *Agrionina*. For example, I possess a ♂ specimen of *Agrion Ramburii*, captured this year amongst a crowd of others, in which the "narrow green lateral vitta" of the dorsum of the thorax is entirely obsolete in the middle and is represented at each end only by a green spot similar to the occipital spots. Again, in a host of species, e. g. in *Agr. civile*, in *Agr. apicale*, as observed by Say himself, and in the unnamed species described by me (*Ill. Pseudoneur*, p. 386) for which I now propose the name of *Agr. Hugeni*, what is sky-blue in the mature, is pale reddish-brown in the immature insect, both in the recent and in the dried specimen. Finally, in *Agr. binotatum* Walsh, the dorsum of the thorax is "pale reddish brown, reddish brown, or in the living mature insect PURPLE fading to reddish brown in death." I have already stated that my specimen of *eurina* was "somewhat immature," and I have little doubt that what I described as "fuscous" in the dorsum of the tho-

rax is normally in the mature insect "blue, somewhat varied with greenish and violaceous," as Say describes it, or "bright metallic blue with greenish and subviolaceous reflections," as Scudder describes it. In other words I believe that my specimen is more or less immature and that Say's typical specimens were fully mature. It will be noticed that in my description of the dorsum of the thorax, for convenience sake, I considered the *pale* color as the ground-color, and that both Scudder and Say consider the *dark* color as the ground-color. In one remarkable point Say's description comes much nearer to mine than to Mr. Scudder's. Say speaks of "a yellow *vitta* on the thorax, *behind bifid and divaricated*." Scudder speaks merely of "a yellowish-brown inconspicuous *line* on the dorsal and lateral sutures." In my insect the dorsal PALE vitta is about $\frac{3}{4}$ millimetre wide and distinctly divaricates on the antealar sinus, (which I expressed by saying that the sublateral DARK vitta was "slightly abbreviated,") while on the other hand the PALE vitta on the lateral suture is about $\frac{1}{2}$ a millimetre wide. The following Table of the principal points of difference in the three descriptions, will, I think, shew that in some other respects my insect comes nearer to Say's description than does the typical Harrisian specimen as described by Scudder :—

<i>L. eurina.</i>	SAY.	SCUDDER.	WALSH.
Labrum.	Yellowish.	Luteous.	Obscure greenish, varied with dusky.
Dark color of dorsum of thorax.	Blue, varied with greenish and violaceous.	Bright metallic blue, with greenish and subviolaceous reflections.	Fuscous.
Pale color of dorsum of thorax.	Yellow.	Yellowish brown.	Rather pale brown.
Femora, beneath.	Whitish.	Yellow.	Yellowish towards the base.
Tibiae.	Black, with an exterior white line.	Lower surface brownish green, upper surface fuscous.	Black, with an "anterior" yellowish vitta.
Pterostigma.	Blackish.	Black.	Brown.

It may here be added that a sketch of the pleura of the Harrisian specimen obligingly furnished to me by Mr. Scudder, agrees exactly with the very remarkable design exhibited in my specimen, nothing

approaching to which has been observed by me in other Agrionina. Mr. Scudder's description of the design of the pleura also agrees exactly with mine, though the coloration differs. The "rather pale brown" vitta on the humeral suture in my specimen would have been more definitely and diffusely described as "rather pale brown along the suture gradually shading into a dark fuscous color towards the yellow part of the pleura."

Note 23, p. 180.—I am now satisfied, from the examination of living Odonata, that the "rhinarium" is merely a coriaceous hinge-like joint connecting the true "nasus" or "epistoma" of Messrs. Selys and Hagen (or what I have erroneously supposed to be the lower half of the front) with the labrum. In *Acheta* Fabr. and British authors (= *Gryllus* of the modern Continental school), there is an almost exactly similar connection. Dr. Hagen states generally of the whole Legion Calopteryx, which includes Heterina, that the "rhinarium is almost obsolete, consisting of a folded membrane." (*Mon. Calopt.* p. 10.) In Coleoptera the subfamily Tenebrionidæ is divided by LeConte into two primary groups, one of which has a similar coriaceous connection between the anterior edge of the front, (which must be considered, I think, as a clypeus with the clypeal suture obsolete) and the labrum. (*Lec. Intro. Col.* p. 224.) Latreille says of Cicada, "Cum clypeo non confundendus marginis frontalis superi processus dilatatus. * * * [Clypeus] a labro pariter discernendus. *Voces illæ sæpius ab auctoribus confuse adhibitæ [sunt.]*" (*Gen. Crust. et Ins.* III. p. 152, note.) It is evident from Prof. Westwood's drawing of the head of Libellula that he considered the "rhinarium" as the true epistoma; for he has entirely omitted the clypeal suture, apparently supposing it, as I formerly did, to be a mere ornamental stria and not a true suture connecting two distinct pieces of the head. (See Westw. *Intr. II.* p. 35, fig. 2.)

Note 24, p. 180.—The following Odonatous species have occurred since the publication of my Paper in *Proc. Phil. Acad. Sc.*

AGRION.

A. dentiferum n. sp. ? (= *signatum* Hagen?) Brassy black. *Head* villose. Occiput with a transverse line, dilating into a cuneiform spot towards the eyes, pale-reddish-brown (fawn-color) in the dried specimen, orange-tawney in the living insect as well as all the other pale-reddish-brown parts; all before a

transverse line drawn behind the antennæ pale-reddish-brown immaculate, except the nasus which is brassy-black all but its anterior edge, the rhinarium which is occasionally obfuscated, and the labrum which generally has a small basal triangular black spot; 2nd joint of antennæ with an interior black spot. 3rd joint fuscous. seta black; lower parts of head very pale yellowish brown. *Prothorax* with its anterior lobe and a small spot behind that lobe, its sides and its posterior lobe, and on its disk a lateral spot and sometimes a pair of abbreviated approximated narrow dorsal vittæ, all pale-reddish-brown; the posterior lobe very narrow throughout and scarcely discernible and with a slight dorsal tubercle. Dorsum of *thorax* villose with a broad, lateral, pale-reddish-brown stripe, occupying $\frac{1}{2}$ of its breadth and not quite attaining the humeral suture above; pleura obscure pale-reddish-brown, except a broad humeral stripe straddling the humeral suture above, a narrow line subobsolete below in the medial suture and a short line under the front wing, all brassy black, and except also the anterior half of the anterior pleural segment which is very pale yellowish brown; sternum whitish. *Abdomen* slender widening on joints 8—10 to nearly twice as wide, with the sides of all the joints pale-reddish-brown; joints 1—7 with a basal pale-reddish-brown annulus occasionally interrupted above, wider, paler and more conspicuous on 4—6; joint 9 entirely pale-reddish-brown; joint 10 dorsally carinate and with a pair of small robust, conical tubercles on the middle of its terminal edge; venter fuscous, often at base and tip pale-reddish-brown. All four *abdominal appendages* pale-reddish-brown, tipped with black and pilose under the lens; the superiors long and robust, the inferiors slender and scarcely half as long as the superiors. Viewed from above the superiors are at base more than $\frac{1}{2}$ as wide as long, whence they taper slightly for $\frac{2}{3}$ their length with one deep dorsal stria, and then taper suddenly to what would be an acute point but for a small robust acute tooth on their interior tip which points inwards. Viewed laterally, they are nearly $\frac{1}{2}$ as wide as long at base, the upper edge straight, the lower edge diverging very slightly to $\frac{1}{2}$ their length, where there is a small robust blunt tooth or tubercle directed downwards, behind which tooth the lower edge slopes suddenly upwards, the tip of the appendages being obtuse and rounded. The inferior appendages taper slightly and are regularly curved inwards, the tip subtruncate. *Legs* pale-yellowish-brown, often whitish towards their tips, femora with a superior and anterior black vitta, the superior vitta especially in the middle and hind legs being very often degraded into a row of black dots sometimes subobsolete in the hind legs; anterior and sometimes the intermediate tibiae with a slender basal anterior black vitta; tarsal incisures and tips of claws slenderly fuscous. *Wings* hyaline; veins black; pterostigma rhomboidal, pale-reddish-brown, marginally much paler or even subhyaline; 10—11 postcubitals ♂ ♀.

The ♀ differs in the pale-reddish-brown parts being greenish blue in the recent, and obscure pale green in the dried specimen. The black line in the medial pleural suture is obsolete except next the wings, and the short black line under the front wing is absent. The abdomen is more robust and does not expand at tip; joint 9 has a large, equilaterally-triangular, brassy-black, dorsal spot extending from base to tip, and joint 10 has merely a narrow brassy-black dorsal

vitta, and its apex is triangularly emarginate; the 8th ventral is tipped with a slender acute spine; and the anal appendages are short, conical, and pale-reddish-brown, scarcely tipped with black.

Length ♂ ♀ 34 mill. Exp. ♂ 37—38 mill. ♀ 42—43 mill. Superior appendages ♂ 1 mill.

Two ♂, two ♀, both pairs taken in coitu in June, not far from a saw-mill. *Agrion binotatum* Walsh, occurred only on and near lografts from Wisconsin, at two different points distant over two miles from each other, whence I infer its true habitat to be Wisconsin. *Dentiferum* differs from *signatum* Hagen, in the pale color not being "yellow," in the superior ♂ appendages being scarcely "subdolabriliform," in the inferior appendages not being "black," and in the pterostigma not being "fuscous." In some respects this species agrees better with *Agrion pollutum* Hagen. Georgia is the northernmost State in which either *signatum* or *pollutum* has been taken, and the ♀ of *signatum* is as yet undescribed. The medial tooth on the superior ♂ appendage of *dentiferum* strikingly recalls some species of *Gomphus*, (*fraternus*, *adelphus* and *vastus*.) There is no better or more reliable character in Odonata than the shape of the ♂ abdominal appendages. It is singular that in the difficult Orthopterous family of Locustariæ Latr. (= Gryllidæ Leach,) although the shape of the ♂ anal appendages varies almost in every species and is very constant in each, precisely as in Odonata, yet Orthopterists have as yet made no use of so important and definite a character.

GOMPHUS.

G. FRATERNUS Say. This species is described in the *Monographie* (p. 125) from two small immature specimens from New York, one ♂ one ♀, the ♂ with its abdominal appendages mostly broken off. Consequently these last have neither been figured nor described. I note the following points in which the description differs from my Illinois specimens, and supply the deficiency in regard to the abdominal appendages. Say's brief description of this species would apply nearly as well to half a dozen others. Nobody but those who, like myself, have examined many scores of specimens of particular species of *Gomphus* from one and the same locality, can form any idea of how constant the size always is and how constant the coloration is except in very immature individuals, and what minute differences of coloration are of specific value. The only very remarkable variable character in this

genus, and that only observable in a few species, is the presence or non-presence of *dorsal* yellow vittæ on the 9th and 10th abdominal joints, which is the more singular as the *lateral* yellow markings of joints 8 and 9 are remarkably constant and afford one of the best specific characters. We may add to this, as variations of a less marked character which also occur in certain species—1st. The confluence or non-confluence, for a short space, near the humerus, of the humeral and antehumeral (dark) stripes, in species which have the intervening pale stripe very narrow. 2nd. The presence or non-presence of the slender "superior" basal yellow vitta of the tibiæ. 3rd. The presence or non-presence of the narrow black edging of the occiput, noticed in 1862, as to the posterior lateral edging in *vastus*, and observed for the first time in 1863, as to the superior edging of the occiput in that species.

In the European *Onychogomphus forcipatus*, however, the laborious researches of Dr. Hagen (Mon. Gomph. pp. 33—40 and Plate 2) have shewn that there are several remarkable *geographical* variations, with transitions from one to the other, and where we should least expect it, in the ♂ abdominal appendages. The Illinois species seem to have these parts nearly as uniform as a set of castings from the same foundry and the same mould.—Owing to my formerly mistaking ♀ *G. consobrinus* n. sp. (described below) for the other sex of ♂ *G. fraternus*, I have erroneously stated in my Paper (p. 393) that the ♀ of *fraternus* has a long, slender, yellowish thorn at each end of the vesicle of the vertex. In reality *fraternus* ♀ has not even the rudiments of any thorn there, while *consobrinus* ♀ has just such a thorn as I have described. I may notice here a remarkable fact, of the truth of which I am satisfied, having observed it for three successive years, and which was the primary cause of the mistake just referred to. In the group *vulgatissimus*, to which belong *fraternus*, *consobrinus* and *gracilinellus*, and also in *vastus* which belongs to the group *dilatatus*, the ♂ ♂ are 4 or 5 times as numerous as the ♀ ♀. On the contrary, in my two closely allied species, *fluvialis* and *amnicola*, the ♀ ♀ are 2 or 3 times as numerous as the ♂ ♂. There is no possibility of mistake in the latter case, as my specimens have been solely obtained from individuals just crawling out of the pupa, and during a long period of time in each year. So far as regards the group *vulgatissimus* the fact is confirmed by what can scarcely be a mere coincidence. In that

group there are four species, and only four species, of which there are in existence nothing but unique specimens, viz.: *melænopis*, *kurikis*, *adelphus* and *quadricolor* n. sp. In all four cases these specimens are ♂ ♂. Supposing no selection to be exercised, and supposing ♂ and ♀ to be equally numerous, the chances are 15 to 1 against such an event happening, whence we may safely infer that the ♀ ♀ in this group are not as numerous as ♂ ♂.

♂ ♀. 1st. The ground color is yellow, almost always tinged with green. 2nd. The labrum is immaculate, except a fuscous dot on its outside basal corner, and it has almost always an impressed median puncture; the central lobe of the labium is obfuscated throughout. 3rd. The large yellow lateral spot at the back of the eyes is always conspicuous, and presents occasionally the appearance of 3, not 2 sub-confluent spots, but the three are almost always entirely confluent. 4th. "The base" [i. e. the posterior prothoracic lobe] "and the POSTERIOR BORDER of the prothorax yellow" (*Monogr. Gomphin.* p. 126) is a manifest clerical or typographical error for "ANTERIOR BORDER"; i. e. anterior prothoracic lobe. The term "base" would include the "posterior border." 5th. It is only occasionally that the humeral fuscous stripe of the thoracic dorsum is confluent with the antehumeral. 6th. It is only in a single ♂ that I can discover any vestige of the "exceedingly slender blackish pleural stripe" in the suture between the meso- and meta-thorax, which M. Selys calls "the second suture," and even in that ♂ it is nothing but an irregular obfuscation.—The anterior dark stripe, which lies midway between the "second suture" and the humeral suture, is interrupted about halfway to the notum, but continued again in a more or less obvious short stripe immediately under the front wing. 7th. In two ♂ only out of seven there is a yellow dorsal vitta on joint 9 of the abdomen, wide in one, narrow in the other; and in the ♂ that has this wide vitta on 9, and likewise in the ♀ which has no vitta on 9, there is also a small median dorsal yellow spot on 10. These markings were described by Say, and traces of them were noticed by Mr. Selys in his ♀. 8th. The large, lateral, basal, yellow spot on abdominal joint 8 varies somewhat in size, and always along its basal $\frac{1}{2}$ attains the margin and occasionally along its whole length; almost always, in addition to this basal spot, there is a submarginal terminal yellow dot or small spot on 8, with which in one ♂ the large

basal spot is partially confluent. 9*th*. The superior ♂ abdominal appendages are as I have described them in *vastus* Hagen, but the change in their curvature takes place at $\frac{2}{3}$ (not $\frac{1}{3}$) of the way to their tips, and instead of the "inferior small spine" at the change of curvature there is an inferior small blunt tooth; the inferior ♂ appendages differ from those of *vastus* in being only $\frac{1}{3}$ (not $\frac{2}{3}$) as long as the superiors, and in gradually curving inwards and upwards for their whole length, their tip obtuse and with a very small terminal thorn directed upwards. In *vastus*, on the contrary, the tip itself "curves suddenly upwards at $\frac{1}{3}$ their length," and terminates acutely in a robust cone when viewed in profile, obtusely when viewed from above; whereas I erroneously described these appendages as "obtuse." 10*th*. There is always a "posterior" yellow vitta, slightly abbreviated at base, on the anterior femur ♂ ♀; and on the posterior femur ♀, but never in ♂, there is an "anterior," unabbreviated, yellow vitta, as in *M. Selys* ♀. The knees are generally spotted with yellow above, and generally on the tibiae there is a slender "superior" basal vitta, which is sometimes subobsolete, and occasionally obsolete. This last vitta is described by Say. 11*th*. The wings are not even "slightly yellowish" at base; the costal vein is almost always conspicuously yellow on the outside; the pterostigma varies from bistre-brown to pale-reddish-brown or fawn-color, and surmounts 3—4½ cells. Antecubitals (front wings) 12—14. Postcubitals 9—12; two discoidal areolets, commencing always with 3 in both wings and in one wing of one ♂ with 4. 12*th*. Instead of the occiput being "more elevated at the sides in ♀ than in ♂," I see no difference. The middle of the ♂ occiput, however, rises much higher above the line of the eyes than the middle of the ♀ occiput, which scarcely rises at all above the line of the eyes. The abdominal appendages in my unique ♀ are yellow, not "black," except at the extreme base and tip.

Length ♂ 53—56 mill. ♀ 54 mill. Expanse ♂ 61—67 mill. ♀ 68 mill. Abd. ♂ 35½—39 mill. ♀ 38 mill. App. sup. ♂ 1½ mill. Hind femur ♂ 9—9½ mill. ♀ 10 mill. Front wing ♂ 31½—33 mill. ♀ 34 mill. Hind wing ♂ 29½—31 mill. ♀ 32½ mill. Pterost. inf. ♂ 3 mill. ♀ 3½ mill. Seven ♂, one ♀. Occurs in June both on the Mississippi and on Rock River. The difference in the coloration of the ♂ ♀ posterior femora is very remarkable and unusual, and re-occurs in *G. graslinellus* Walsh, (see below.) In the *Synopsis of N. A. Neur.* (p.

105, line 2), instead of "anterior and posterior femora partly yellowish," we should read "anterior ♂ ♀ and posterior ♀ femora partly yellowish."

G. GRASLINELLUS Walsh. For the sake of brevity I described this species by its differences from *G. fraternus*. Owing to the confusion already referred to as made by myself between *consobrinus* n. sp., and *fraternus* Say, I unnecessarily stated that in ♀ *graslinellus* there was no lateral thorn on the vertex. From the same cause I omitted to state that in *graslinellus* there are two uninterrupted blackish stripes on the thoracic pleura, viz., one on the suture behind the spiracle, and one half-way between that and the humeral suture, and also that the space between these two stripes, as in *consobrinus* n. sp., is livid not yellow. The hind femora are also shorter than those of *fraternus* in the proportion of $7\frac{1}{2}$ to 10 i. e. one-fourth shorter. In describing the superior abdominal appendages ♂ *graslinellus*, by a clerical error I stated the large lateral tooth to be "quadrangular," instead of "rectangular." In its European representative, *G. graslini*, the lateral tooth is figured by Dr. Hagen as having its sides at an angle of about 50° or 60° to each other (*Mon. Gomph.* Plate 8, fig. 3.) So far as I recollect, the dorsum of the 9th and 10th abdominal segments varied in its coloration as in *fraternus*, but vice versa, being generally marked above with yellow and only occasionally immaculate. The four specimens, however, which I still have on hand, have each a simple, moderately wide, dorsal, yellow vitta on these two joints. I ought to have added also, that in ♂ *graslinellus* the terminal abdominal joints are as much dilated as in ♂ ♀ *fraternus*, and that in ♀ *graslinellus* they are scarcely dilated at all. As in *fraternus* ♀, so in *graslinellus* ♀ (3 specimens) the posterior femur is "anteriorly" vittate with yellow for $\frac{1}{2}$ – $\frac{2}{3}$ the way to its tip, whereas in both species the ♂ posterior femur is immaculate, save that the knees are spotted with yellow above, as well as all the knees ♂ ♀. In the allied *G. vastus* (6 ♂, 5 ♀) and in *consobrinus* n. sp. (3 ♂, 2 ♀), I find no trace of this singular sexual character. Another equally singular sexual character is found in the tarsal claws of *consobrinus* and *externus* and is noticed below.

G. consobrinus n. sp. ♂ Yellow, very slightly tinged with green. Head with the occiput a little rounded above, but with the centre scarcely higher than the line of the eyes, fringed above with black hairs. All between the occiput and

the front black. Vesicle of the vertex loftily cariniform, transverse, a little emarginate in the middle and suddenly rounded off at each end. First joint of antennæ annulate with whitish at tip. Upper surface of front with a narrow basal fascia, varying in color from dark brown to very pale reddish brown and with its central $\frac{1}{2}$ extending forwards in a very obtuse angle. Labium whitish, the central lobe and the basal half of the lateral lobe generally obfuscated; back of the head blackish, with a lateral row of three yellow confluent spots immediately behind the eyes. *Prothorax* black above, with its anterior and posterior lobes, two confluent spots before the posterior lobe and a large lateral spot, all yellow. Dorsum of *thorax* with the dorsal carina yellow only from its posterior bifurcation half-way to its tip, elsewhere black. Stripes of the dorsum dull black; the median stripes confluent, not attaining the anterior margin by $\frac{1}{2}$ a millimetre, but attaining the antealar sinus, very slightly wider in front and excurved at the extreme tip. The antehumeral broader than the median, attaining the anterior margin but tapering behind and not quite attaining the antealar sinus. The humeral in front as wide as the median, and behind wider, where it is often confluent with the antehumeral, the intervening yellow stripe being throughout very narrow. Antealar sinus black, the posterior middle and the angle next the front wing yellow. Pleura of the thorax with two unabbreviated blackish stripes, one on the suture behind the spiracle and one half-way between that and the humeral suture, the intervening space dull pale-purple (lilac) in the living insect and livid in the dried specimen, and the two blackish stripes shading off gradually into the livid color. Spiracle black. Sternum pale-greenish-gray. *Abdomen* black, expanded ♂ ♀ on joints 7–9 as in *fraternus* ♂ ♀, and marked with yellow on the dorsum as follows:—1, with a large quadrangular spot confluent with a small spot or dot in front, both together covering its entire length; 2, with the usual trilobate vitta; 3–7 with the usual trilobate narrow vitta tapering to a sharp point at tip and not quite attaining the tip of each joint; 8 with a shortish triangular basal spot; 9 with a vitta, scarcely abbreviated at tip, sometimes broad, sometimes narrow, and varying much in shape; 10 with a dorsal median rhomboidal spot or dot. Laterally, joints 1, 2, 9 and 10 are yellow, 10 very narrowly so; 3–6 are obscurely clouded, with a less obscure basal triangle, the color of both cloud and spot in the living insect being a dull pale purple, and in the dried specimen a dull gray; 7 with a basal triangle of the same color as 3–6 and a median yellow vitta; 8 with a basal yellow spot, reaching about half-way to the tip and always attaining the margin throughout, and also with a submarginal terminal yellow dot. Earlets yellow, tipped behind with minute black teeth. Venter blackish, generally yellowish at tip and sometimes at base. The *abdominal appendages* are black and hairy; viewed from above the superiors are more than $\frac{1}{2}$ as long again as the 10th abdominal, wide apart at base, slightly divaricate, tapering rapidly and chiefly on the inner side for $\frac{1}{2}$ their length, then very slowly for the next $\frac{1}{2}$, when they again taper very rapidly and chiefly on the inner side and terminate in a slender thorn. Viewed laterally, their upper edge is perfectly straight, except that it curves very slightly downwards at their extreme base and very slightly upwards at their extreme tip; their lower edge converges with the other edge at an angle of 45° for $\frac{1}{2}$ the length of the

appendage, then suddenly diverges from it, at an angle of about 100° or 110° with its former course, till it attains $\frac{1}{2}$ the distance to the tip, then suddenly angles off to the tip, which is acute, in a straight line, which, at $\frac{2}{3}$ of the distance from the last angulation to the tip, has a slight emargination in it followed by a very small tubercle. The inferiors extend $\frac{2}{3}$ as far as the superiors, and are yellowish at their origin, horizontally flattish, wider apart at base than the superiors, tapered regularly and slowly, almost at right angles to the abdomen for $\frac{1}{2}$ their length, when they curve inwards and upwards and terminate in an obtuse point with a minute spine at its tip directed upwards. Legs black; femora with short promiscuous spines, hind femora also with a double row of spines, gradually longer towards the tip and longest a little before the tip. Anterior femora with a "posterior" yellow vitta slightly abbreviated at base. In one immature ♂ all the femora are yellowish except "superiorly." Knees spotted with yellow above; tibiae above with a slender basal yellow vitta. In the immature ♂ the base of the tarsal claws is pale. Wings hyaline, veins black. the costal vein conspicuously yellow in front to the tip of the pterostigma. Pterostigma ranging from dark reddish brown to very pale reddish brown in the immature ♂, and surmounting $3\frac{1}{2}$ — $4\frac{1}{2}$ cells. Membranule moderate, whitish. Antecubitals ♂ ♀ 12—15; postcubitals ♂ ♀ 10—13; two discoidal areolet ♂ ♀, always commencing with three both in front and hind wing.

The ♀ differs as follows:—1st. The occiput is laterally nearly quite straight, but rises suddenly in its middle $\frac{1}{2}$ in two confluent curves, which however are scarcely elevated above the line of the eyes. 2nd. At each end of the vesicle of the vertex, adjoining the eyes, there is a slender acute yellowish thorn, as long as the second joint of the antennae. 3rd. The double row of thorns on the hind femur has the longest ones in its middle, where they are twice as long as the longest on the ♂ femur. 4th. The basal $\frac{1}{2}$ of the tarsal claws, and more conspicuously so in the hind legs, is rufous. 5th. The pterostigma is pale reddish-brown in the mature specimen.—The ♀ abdominal appendages are fuscous, elongate-conical, slightly curved outwards and upwards near the tip, and terminating in a slender thorn; the anal processes are yellow, the superior one half as long as the appendage, the inferior a little longer; the superior one semicircular, the inferior one transversely semi-oval and slit lengthways to its base. The vulvar lamina is yellowish fuscous, full half as long as the 9th ventral, and bifid fully half-way to its base, the tips curving apart horizontally nearly in a rectangle.

Length ♂ 55—59 mill. ♀ 57—60 mill. Expanse ♂ 60—69 mill. ♀ 66—75 mill. Abd. ♂ 39—41 mill. ♀ 41—43 mill. Append. sup. ♂ $1\frac{1}{2}$ mill. Hind femur ♂ $9\frac{1}{2}$ — $10\frac{1}{2}$ mill. ♀ $10\frac{1}{2}$ — $11\frac{1}{2}$ mill. Longest thorns ♀ hind femur 1 mill. Front wing ♂ $32\frac{1}{2}$ — $34\frac{1}{2}$ mill. ♀ 36— $36\frac{1}{2}$ mill.; its width ♂ 7— $7\frac{1}{2}$ mill. ♀ $7\frac{1}{2}$ —8 mill. Hind wing ♂ 31—33 mill. ♀ 34—35 mill.; its width ♂ 9— $9\frac{1}{2}$ mill. ♀ $9\frac{1}{2}$ —10 mill. Pterost. inf. ♂ $3\frac{1}{2}$ —4 mill. ♀ 4 mill. Width of 8th ventral ♂ ♀ $2\frac{1}{2}$ mill.

Three ♂, two ♀.—Differs from *fraternus* as follows:—1st. The average size is fully $\frac{1}{18}$ larger. 2nd. The ♀ vertical vesicle is laterally thorned. 3rd. The median black stripe of the thoracic dorsum is wider and the adjoining yellow stripe consequently narrower, which

gives the insect a very different appearance. 4th. The anterior blackish stripe of the pleura is never interrupted or abbreviated, there is a distinct posterior blackish stripe on the pleura, and the space between the two is pale dull purple or livid instead of greenish yellow. 5th. The ♂ anal appendages are entirely different. 6th. The hind femur ♀ is not "anteriorly" yellow.—From all other allied species, except *graslinellus* Walsh, and *quadricolor* n. sp. (described below,) *consobrinus* differs in the space between the 1st and 2nd pleural stripes being livid;* from *graslinellus* the ♂ differs in the abdominal appendages not having a large lateral rectangular tooth and the ♀ in having a lateral thorn to the vertical vesicle. From all allied species, excepting 1st. *externus* Hagen, of which more below, 2nd, *intricatus* Hagen, which is very much smaller and quite different and belongs to a different group, and 3rd, *spoliatus* Hagen, it differs essentially in the shape of the ♂ abdominal appendages. As to *spoliatus*, in size and in ♂ abdominal appendages *consobrinus* closely resembles that species, the ♀ of which is unknown, but it is separated at once, 1st, by the median and antehumeral stripes of the thorax being very wide apart and not connected by a black band above and below, 2nd, by the abdominal appendages ♂ not being yellow at base and middle, and 3rd, by the hind femora being $\frac{1}{2}$ shorter in proportion and much less formidably spined. From *dilatatus*, *externus*, *vastus* and *ventricosus* n. sp., it differs in the tip of the abdomen not being so widely expanded—which in that group is caused by the terminal VENTRAL segments being much wider than usual. Finally, from *adelphus*, *dilatatus*, *vastus*, *vulgatissimus* (Europe), *melænops* (Japan), *simillimus* (Europe), *Lucasii* (Africa), *pulchellus* (Europe), *Graslini* (Europe), and *flavipes* (Europe), it differs by the face being immaculate.

This species singularly resembles *externus* (Texas) in all its measurements, except that it is at least one-seventeenth larger and the pterostigma one-sixth longer. It resembles it also in the minutest details of its coloration, even down to the ♂ ♀ tarsal claws, except that in that species the carina of the thoracic dorsum is yellow throughout, the

* In the exotic subgenus *Cyclogomphus* the 1st and 2nd pleural stripes are described as confluent, and it is stated that this character is not found in any other group. (*Mon. Gomph.* p. 105.)

pleura is not described as livid between the blackish stripes, and its ♀ hind tarsi are said to be "yellow in the middle," no traces of which color are discoverable in the tarsi of ♀ *consobrinus*. But 1st *externus* is said, when compared with *fraternus*, to have "its terminal abdominal segments very much more dilated, so as always to prevent any confusion between the two species," and *consobrinus*, when placed side by side with *fraternus*, exactly resembles that species in the structure of its terminal abdominal segments. 2nd. The ♀ of *externus* is known and described, yet no mention is made of the remarkable and conspicuous yellowish thorns on the ♀ vertex which are found in ♀ *consobrinus*. 3rd. The posterior femora of *externus* ♂ ♀ are said to have, besides the short promiscuous spines, "an external series of spines of which a dozen are successively longer," whereas in ♂ ♀ *consobrinus* there is not only an external, but a distinct internal series also, but slightly shorter than the external ones. 4th. Neither the description (p. 412) nor the figure (Plate 21, fig. 2) of the ♂ abdominal appendages of *externus* precisely agree with those of *consobrinus*; still the differences in their structure are not fundamental. The vulvar lamina agrees exactly, and the ♂ genitals pretty closely, so far as they are figured.

G. quadricolor n. sp. ♂ Pale green. Head with the occiput ciliated above with black hairs and regularly rounded in a circular arc of 45°, so as to be cut off nearly throughout by a line drawn from the top of one eye to the top of the other. All between the occiput and front black. Vesicle of the vertex loftily cariniform, transverse, scarcely emarginate in the middle, and curving downwards very suddenly at the sides towards the eyes. Upper surface of the front with a basal black band, parallel with its anterior edge except that it is acutely emarginate laterally at $\frac{1}{4}$ of its entire width. Labium pale livid green, the exterior margin of its lateral lobes yellowish; back of the head blackish, but along the lateral margin of the eyes with a large, ill-defined, elongate, yellow spot. Prothorax black, with the anterior lobe and a small double spot on the posterior lobe yellow, and a double discoidal spot and a large lateral one green. Dorsum of thorax with the stripes black; the carina green only half-way from its posterior bifurcation to its tip, elsewhere black. The two median stripes confluent, gradually wider in front, squarely truncate in front, not attaining the anterior margin by $\frac{1}{2}$ a millimetre, but narrowly confluent along the front of the antealar sinus with the antehumeral. The antehumerals wider, their sides parallel in front but converging behind, nearly twice as near to the medians behind as they are in front. The humerals as wide as the medians, and wider behind than in front, separated in front from the antehumerals only by a narrow green line, and confluent with them for a short space at $\frac{1}{2}$ the distance

from their tips to their base, when they diverge widely so as to leave a triangular green spot which almost attains the antealar sinus. Pleura with an ill-defined pale dusky stripe in the suture behind the spiracle, and a well-defined dusky one half-way from this suture to the humeral one, the intervening space livid. The entire space between this last stripe and the humeral one greenish yellow, yellowish above and below. Spiracle black. Sternum dull greenish gray behind. Antealar sinus black on its anterior $\frac{1}{2}$; origin of wings black; meta- and mesothoracic scutels vivid yellow. *Abdomen* black, with joints 7—9 moderately expanded as in *fraternus*, and 9 a trifle longer than 8. Joint 1 is entirely green except a hairy black stripe extending from the lateral tip of its dorsum nearly to the centre of the dorsum; 2 is laterally pale-green with some irregular yellow freckles, with the usual trilobate dorsal vitta which is pale-green. Along the middle of this vitta, as well as the middle of joint 1, extends a longitudinal very irregular, vivid yellow line, alternately contracting and expanding and throwing off lateral fine yellow lines. The remaining joints are marked dorsally as follows with greenish yellow:—3 has the usual narrow, pointed, trilobate, vitta scarcely attaining the tip, and 4—7 a narrow pointed vitta reaching only $\frac{1}{2}$ of the way to the tip, with rudiments of a short basal vitta on 8. Laterally 3—7 have an obscure yellow triangular basal spot, 8 and 9 are submarginally yellow except at base and tip; the terminal $\frac{1}{2}$ of the margin of 8 and the whole of the margin of 9 are also yellow; and 10 has an obscure yellowish cloud along its lateral margin. Earlets green with very minute black teeth; venter blackish. *Abdominal appendages* black and hairy, the superiors $\frac{1}{2}$ longer than the 10th abdominal joint, wide apart at base and moderately divaricate, the inferiors $\frac{1}{2}$ shorter than the superiors, still wider apart at base and still more widely divaricate than the superiors. Viewed laterally from above at an angle of 45° to the perpendicular, the superior appendage which is next the eye is regularly tapered, except that it is trumpet shaped and much expanded on its basal $\frac{1}{2}$ especially on the inside, and has its extreme tip suddenly contracted on the outer side and terminating in a small acute thorn. The appendage furthest from the eye, from the same point of view, has its upper edge sinuate for $\frac{2}{3}$ its length in two exceedingly gentle curves, the first twice as long as the second, when the appendage turns slightly upwards in the form of a straight, fusiform, robust, acute thorn occupying the other $\frac{1}{3}$ of its length. From the same point of view, the lower edge of the same appendage for $\frac{1}{2}$ its length diverges from the upper edge in a very gentle concave curve till it is twice as far from it as it was at base, when it turns suddenly upwards in a direction at right angles to the upper edge till it has travelled full $\frac{1}{2}$ of the way to it, thereby forming an acutely angular tooth, and then runs in a very gentle curve, whose convexity is downwards, to the base of the terminal fusiform tooth. The inferior appendages are rounded below, flat above, but slightly tapering, and with their upper edge perfectly straight till they attain their utmost limit, when the extreme tip which is obtuse turns upwards in the form of a small robust thorn. *Legs* black, the anterior femora and trochanters with a "posterior" pale green vitta. *Wings* hyaline, slightly flavescent at base; veins black, the costal vein pale green in front as far as the pterostigma; pterostigma dark red-

dish brown, surmounting 3—4 cells; membranules rather small, whitish; angle of hind wings very acute. Antecubitals 13; postcubitals 10—12; two discoidal areolets commencing with 2, in one hind wing with 3.

Length ♂ 45½ mill. Exp. ♂ 55 mill. Abd. ♂ 33 mill. Front wing ♂ 27 mill. Hind wing ♂ 25½ mill. Hind femur ♂ 6½ mill. Pterost. infer. ♂ 2½ mill.

One ♂; ♀ unknown. There are four distinct colors in this insect, viz.: black, lilac, green and yellow, whence the specific name. The contrast between the green, which is almost bluish-green, and the bright vivid yellow is very striking, and the details were most of them noted from the living insect. The contrast is just as apparent in the dried specimen. In *vastus* ♂ ♀ there is a somewhat similar contrast, which I did not notice in my description, the meso- and metathoracic scutels being yellow more or less bright and the thoracic notum greenish yellow; and in one specimen there is a bright yellow spot on the greenish-yellow dorsal vitta of the 2nd abdominal. This elegant little species can be confounded with no allied U. S. species but *adelphus* Selys, owing to its minute size; and it differs from *adelphus* 1st, in the face being immaculate. 2nd, In the occiput not being "blackish" behind. 3rd, In the back of the head not being blackish immaculate. 4th, In having no black spot behind the coxæ of the hind legs. 5th, In the sides of abdominal joints 8 and 9 not being black, immaculate. 6th, The superior abdominal appendages of *adelphus* are described as having their tooth spring from the *outside* edge of their inferior surface and point *downwards*, whereas in *quadricolor* it springs from the *inside* edge and points obliquely *inwards* at an angle of 45°. 7th, Although *quadricolor* is $\frac{1}{17}$ larger than *adelphus*, its posterior femur is $\frac{1}{4}$ shorter. 8th, The femora of *adelphus* are immaculate, except a yellow point at the knee; those of *quadricolor* are immaculate except that the anterior femora and trochanters are posteriorly yellow.—Of the foreign allied species it is separated at once from *vulgatissimus*, *similimus*, *pulchellus*, *graslini* and *flavipes*, all 5 of Europe, and from *melænops* (Japan), and *Lucasii* (Africa), by its face being immaculate. From a closely allied species (length 48 mill.) inhabiting the Kurile Islands, south of Kamtschatka, of which only a single specimen in bad condition is known to exist, *G. kurilis*, it differs as follows: 1st, *Kurilis* has the occiput "almost straight," and what is singular "not oiliated." 2nd, The dorsal abdominal vitta of *kurilis* is continuous on joints 4—7, in *quadricolor* it is widely interrupted at the tip in joints

4—7. 3rd, In *kurilis* the legs are "all black." 4th, The ♂ abdominal appendages are entirely different.

G. ventriosus n. sp. ♂ Greenish yellow. Head with the occiput straight, except laterally, and in the exact line of the eyes, fringed with black hairs. All between the occiput and front black; tip of the first joint of antennæ whitish. Vesicle of vertex straight, transverse, cariniform, suddenly rounded off at the sides. Upper surface of the front with a very narrow basal black fascia. Central lobe of labium blackish. Back part of head blackish, laterally yellow immediately behind the eyes. Prothorax black above, with the anterior and posterior lobes, a double spot before the posterior lobe and also a lateral spot, all greenish yellow. Dorsum of thorax with its stripes deep black, as in *vastus*; the dorsal carina yellow from its bifurcation almost to its extreme tip, elsewhere black. The median stripes confluent, scarcely wider in front, obliquely truncate at tip so that their extreme tip just attains the tip of the carina, narrowly confluent behind along the antealar sinus with the humeral. The humerals confluent throughout with the antehumerals except in front for $\frac{1}{4}$ their length, where the separating yellow line is very narrow, and except also that the hind end of the antehumeral separates itself from the two united stripes in the form of a large triangular black tooth which does not attain the antealar sinus by one millimetre. The two united stripes are nearly twice as wide as the united medians and are unabbreviated. Antealar sinus black, yellowish on the middle $\frac{1}{2}$ of its posterior half; origin of wings blackish; meso- and metathoracic scutels a vivid yellow. Sternum pale dull green, behind dull greenish gray. Pleura with a narrow dusky stripe midway between the humeral suture and that behind the spiracle, which stripe does not ascend towards the wing beyond the spiracle; spiracle blackish. Abdomen black, joints 7—9 greatly dilated and widely margined, especially 8, precisely as in *G. vastus*; joint 1 laterally pale dull green and with a large obtrigonal dorsal pale green spot not quite attaining the base and tip; 2 laterally pale dull green and with the usual trilobate dorsal vitta, which is pale green with a central, unabbreviated longitudinal, yellow line. The remaining joints are marked on the dorsum with greenish-yellow as follows:—3—6 with the normal trilobate vitta, a little wider than usual, not very acute at tip, and just attaining the subterminal short spines of each joint; 7 with a lanceolate very acute vitta extending $\frac{3}{4}$ of the way to the tip, and also with the narrow annulus behind the subterminal spines yellowish. Laterally 3—6 have a basal triangular spot, much larger on 3, and a faint marginal vitta, all obscure greenish yellow; 7 has the same basal triangle, and also confluent with the triangle an irregular median yellow spot, which leaves the terminal $\frac{1}{4}$ of the expanded margin of the joint black; 8 has a large unabbreviated yellow vitta which leaves the expanded margin black, and 9 has a narrower unabbreviated vitta, which, as well as the margin, is yellow. Earlets anteriorly shining black, posteriorly with small black thorns. Venter blackish. Abdominal appendages black and hairy. Viewed from above the superiors are wide apart at base, twice as long as the last abdominal joint, slender, conical, but slightly divaricate, straight, tapering to a long acute point,

the outer side with an attenuated margin (or flange) which is narrow to $\frac{1}{4}$ their length and then expands slowly and gradually as far as $\frac{1}{2}$ their length, when it is suddenly contracted to $\frac{1}{2}$ its width, so as to form an angular tooth, and tapers out at $\frac{2}{3}$ their length. Viewed laterally the superiors taper rapidly on their basal $\frac{1}{4}$ and afterwards very slowly; and they curve downwards, their lower edge describing a circular arc of 45° for 4-5ths their entire length, then suddenly become straight and taper to a very fine, long, acute point. At the change in the curvature there is an elongate inferior tubercle, truncate for its whole length in a direction parallel with the straight terminal portion of the appendage, and about 1-7th or 1-8th as long as the appendage itself. The inferiors are $\frac{2}{3}$ as long as the superiors, as wide apart at base as they are and more divaricate, obliquely but almost vertically flattish, rapidly tapered when viewed flatways, very slowly tapered when viewed edgeways, their inside surface a little excavated, their outer surface a little rounded, straight for $\frac{2}{3}$ their length, when they curve inwards and upwards in a quadrant and terminate in a robust cone with a very minute thorn at tip directed upwards. *Legs* black; anterior femora with a "posterior" pale green vitta. *Wings* hyaline, scarcely flavescent at base; veins black, the costal vein greenish yellow in front to the pterostigma; pterostigma dark brown, surmounting $3\frac{1}{2}$ —4 cells; membranules moderate, whitish. Antecubitals 11; postcubitals 10. Two discoidal areolets, commencing with 3 in both wings.

Length \textasciitilde 48 mill. Expanse \textasciitilde 57 mill. Abd. \textasciitilde $34\frac{1}{2}$ mill. Sup. wing \textasciitilde $30\frac{1}{2}$ mill. Inf. wing \textasciitilde $29\frac{1}{2}$ mill. Pterost. inf. \textasciitilde 3 mill. Post. femur \textasciitilde 8 mill. Append. sup. \textasciitilde $1\frac{1}{2}$ mill. Width of 8th ventral \textasciitilde $3\frac{1}{2}$ mill.

One \textasciitilde ; \textasciitilde unknown. In measuring the width of the 8th ventral in *Gomphus* care should be taken not to include the spiracle-bearing membrane which connects what may be called the "sternum" or central piece of the venter with the attenuated margin or "pleura" of the dorsum. In Odonata the abdominal spiracles are situated in this membrane, generally close to the "sternum," and are generally very small and not easily seen except by inflating the abdomen; which individual *Gomphus* sometimes do of their own free will in the interval between their capture and their death. The subfamily Gomphina, which has the tip of abd. \textasciitilde more or less dilated, is remarkable for the spiracle of the 8th ventral being larger than the others and very conspicuous. Just so *Dytiscus* in Coleoptera, who has a habit of sticking his anus out of the water to draw his breath, has his anal spiracle much larger than the others. In *vastus* and *ventricosus* and probably in the other two species belonging to this group, this spiracle on the 8th ventral is situated rather further from the ventral "sternum" than in other *Gomphus*. *Ventricosus* is readily distinguishable from all allied *Gomphus* but *dilatatus*, *externus* and *vastus* by the terminal abdominal joints being

very widely distended, joint 8 expanding $6\frac{1}{2}$ mill. in consequence of the unusual width of the terminal ventrals. From *dilatatus* it is at once separated by the much larger size of that species, the total length of which is 72 mill. and that of the superior wing 41 mill., and also by the face of *dilatatus* being fasciate with black.—From *externus* it differs as follows:—1st. The stripes of the thoracic dorsum are deep black, as in *vastus*, not “brown.” 2nd. The humeral and antehumeral are confluent nearly throughout; in *externus* they are not confluent at all. 3rd. The posterior pleural stripe is absent and the anterior one abbreviated above, nearly as in *fraternus*; in *externus* both stripes are present and unabbreviated. 4th. Abdominal joints 8—10 are dorsally immaculate; in *externus* they are distinctly vittate with greenish yellow. 5th. The earlets are widely tipped with black as in *vastus*; in *externus* they are immaculate with fine black teeth. 6th. The posterior femur is only $\frac{1}{2}$ of the total length of the body; in *externus* it is nearly $\frac{1}{2}$.—Finally, although at first sight it would easily be confounded with *vastus*, it differs from that species as follows:—1st. The size is smaller, the smallest specimen of 6 ♂ *vastus* now before me being $52\frac{1}{2}$ mill. long, sup. wing $32\frac{1}{2}$ mill. Out of eleven ♂ *vastus* measured by me in 1862, the length only varied from 53—55 mill., and three ♀ the same. 2nd. The face is immaculate; in *vastus* the face (if we include the labrum) is trifasciate with black. 3rd. It has one long yellow spot behind the eye; *vastus* has two small ones which are never confluent. 4th. The median thoracic stripe is rather narrow, its sides are parallel and it is obliquely truncate at tip, the obtuse angle outwards; in *vastus* (11 ♂ & ♀ specimens) the median thoracic stripe is wider, distinctly obtuneiform, and obliquely truncate at tip, the acute angle outwards, except in a single ♂ where it is squarely truncate and scarcely obtuneiform. 5th. The humeral and antehumeral are confluent for a long space; in *vastus* never at all. 6th. It has only one pleural stripe, and that abbreviated on its upper half; *vastus* has two, never abbreviated, though the anterior one is sometimes interrupted for a short space. 7th. The dorsal vitta of abdominal joints 3—6 is scarcely abbreviated at tip; in *vastus* it is greatly abbreviated. 8th. In *vastus* there is a small inferior thorn near the tip of the superior abdominal appendage ♂; in *ventricosus* this thorn becomes a long truncate tubercle. In *ventricosus* there is a distinct lateral flange on the outside

of this appendage; in *vastus* there are slight rudiments only of such a flange, which I omitted to mention in my description, for the sake of brevity.

G. FLUVIALIS Walsh, and *G. AMNICOLA* Walsh. I ought to have stated as one of the sexual distinctions of these two closely allied species, that the terminal joints of the ♀ abdomen are not nearly as much dilated as in ♂ — in fact scarcely dilated at all. In the ♂ the terminal joints are dilated about $\frac{1}{4}$ as much as in *G. fraternus*. In this respect these two species differ from the characters of the group *pallidus* (Selys,) which is the only one to which they can with any propriety be referred, and which is stated have the terminal joints (♂ ♀ ?) "very little dilated." (Mon. Gomph. p. 118.) They differ also in the ♂ abdominal appendages not being "yellowish," but brown-black or black. They are likewise unlike "*pallidus* and certain allied species" in the ♂ not having its femora "very hairy," but on the contrary destitute of any but a few scattering basal hairs which are also found in ♀. Probably they form a distinct group.

Of the great genus *Gomphus* there are now no less than 86 described species, including the three described above and the six described in my former Paper on Pseudoneuroptera. Of these 86 no less than 36 occur in North America, and at least 26 and perhaps 30 within the limits of the United States. Messrs. Selys and Hagen have divided this Genus into 16 subgenera, six of which are found in America, either North or South, and five within the limits of the United States. The following Synoptical Table expresses as briefly as possible the structural relations of these six American subgenera. In giving more weight to structure and less to coloration I have deviated from the path travelled by M. Selys in his Analytical Table of the whole number of Subgenera. (Mon. Gomph. p. 14.)

G. GOMPHUS AND ITS AMERICAN SUBGENERA.		SUBGENERA.
Inferior ♂ abdominal appendages not divaricate.	Stripes of the thoracic dorsum more or less obsolete; legs short; occiput ♂ ♀ unarmed.	ERPETOGOMPHUS.*
	Stripes of the thoracic dorsum distinct; legs long; occiput ♂ unarmed, occiput ♀ with large horns.	OPHIOGOMPHUS.*
Inferior ♂ abdominal appendages widely divaricate.	Internal vein of the pterostigma not prolonged; vesicle of the vertex semi-circular.	MACROGOMPHUS.†
	Abdominal joint 9 at least $\frac{1}{2}$ as long again as 8; 10 very short, from $\frac{1}{2}$ — $\frac{1}{3}$ of 9. Earlets ♀ subobsolete as usual.	ERIGOMPHUS.‡
	Abdominal joint 9 about equal to 8; 10 about half as long as 9. Earlets of ♀ as large as they commonly are in ♂ Gomphina.	
	Internal vein of the pterostigma prolonged as usual; vesicle of the vertex straight or nearly so.	GOMPHUS.
	Abdominal joint 9 about equal to 8; 10 half as long as 9 or less.	NEOGOMPHUS.
	Abdomen with joints 8—10 gradually diminishing in length.	

*These two subgenera were originally united under Ophiogomphus by M. Selys. I retain them as separate in deference to his high authority, but I can perceive no distinguishing characters that are not rather of specific than of subgeneric value. To consider the characters laid down by Messrs. Selys and Hagen in detail:—1st. *The difference in the thoracic stripes.* If species with the normal thoracic stripes *subobsolete* are to be placed on that account in a separate subgenus from those with the normal thoracic stripes *distinct*, surely those with the normal thoracic stripes *entirely absent* ought also to be placed in a separate subgenus. Now Mr. Selys himself refers to Erpetogomphus a species (*boa*) with the thorax immaculate; (Addit. Synops. Gomph. p. 11,) and I have described another one (*rupinsulensis*), which also has the thorax immaculate. 2nd. *The different length of the legs.* Calculating from M. Selys' own measurements, in *Erp. crotalinus* ♂ the hind wing is 4.28 of the hind femur, while in *Oph. colubrinus* ♂ and *Oph. serpentinus* ♂ the hind wing is respectively 4.21 and 4.20 of the hind femur—the difference in this respect between the two subgenera being as small as it well could be. It is possible, however, that the tibiae in Ophiogomphus may be disproportionately elongated, so that the entire hind leg may be relatively to Erpetogomphus much longer, instead of being subequal as we should infer from the subequality of the hind femora. But even allowing that the legs of all known Erpetogomphus are short, and those of all known Ophiogomphus long, the enormous and yet very gradual difference in the length of the hind femur between the different species of the Subgenus

CORDULIA.

C. ? molesta n. sp. ♀ Pale dull brownish olive, both in the living and in the dried specimen; almost immaculate. *Head* pilose; antennal seta brown: mouth and all beneath paler; behind the tubercle of the eyes some obscure yellow markings. *Thorax* pilose; dorsum of thorax with a much darker broad dorsal stripe, shading off into the ground-color half-way to the humeral suture; dorsal carina yellowish. Pleura with a yellowish stripe on the spiracle, obsolete

Gomphus, seems to indicate that in the entire genus Gomphus the length of the legs is a character not of subgeneric, but merely of specific value. For example, calculating from M. Selys' own measurements, in *G. dorsalis* ♂ the hind wing is 4.60 of the hind femur, in *intricatus* ♂ 4.58, in *simillimus* ♂ 4.51, in *pulchellus* ♂ 4.33, in *lividus* ♂ 4.13, in *graslini* ♂ 4.06, in *pilipes* ♂ 3.94, in *flavipes* ♂ and *militaris* ♂ 3.93, in *occipitalis* ♂ and *Kurilis* ♂ 3.87, in *vulgatissimus* ♂ 3.86, in *spicatus* ♂ 3.85, in *melanops* ♂ 3.80, in *minutus* ♂ 3.73, in *adelphus* ♂ 3.33, in *dilatatus* ♂ 3.20, in *fraternus* ♂ 3.11, in *spinosus* ♂ and *armatus* ♂, which are grouped separately from all the others except *spoliatus* as having "excessively long hind femora," no less than 3.04 or only .07 less than *fraternus* ♂! and finally in *externus* ♂ 3.00 and in *spoliatus* ♂ 2.80, the last species but one being grouped as having "hind femora of the ordinary length," and yet actually having the longest hind femora of any of them, with the single exception of *spoliatus*!—3rd. As to the character drawn from the very remarkable armature of the ♀ occiput in Ophiogomphus. (*Mon. Gomph.* Plate V. fig. 2. h), M. Selys himself, in the earlier part of his great work, laid it down as one of the characters of the subgenus Macrogomphus, that the ♀ "had a protuberance on the middle of the occiput," (p. 87,) but he subsequently allowed that "this character was only a specific one." (p. 428.) Are not the horns of the occiput in ♀ Ophiogomphus likewise only of specific value? We see that in the foreign subgenus Onychogomphus one species (*Cerastes*) has horns on the ♀ occiput (*Mon. Gomph.* Plate IV. fig. 2. b.); yet it is not on that account placed by M. Selys in a different subgenus from the other 13 species which have no occipital horns.—4th. Considerable stress is laid, especially by Dr. Hagen, upon the fact that Ophiogomphus has a tooth upon the second joint of the penis, while Erpetogomphus has none. But the most recent researches of Dr. Hagen have shown that some species of the foreign subgenus Onychogomphus have this tooth and some have not. (*Mon. Gomph.* p. 429.) It would seem, therefore, that neither can this character be of subgeneric value in Gomphus.—5th. It is said that the vesicle of the vertex is divided into two tubercles in Erpetogomphus, and is simple and normal in Ophiogomphus. But my *Erpetogomphus rupinsulensis* has the vertical vesicle "scarcely emarginate."—6th. The comparative length of the two terminal abdominal joints is not, in reality, sufficiently different in in the two subgenera to be relied on as a distinguishing character. M. Selys stated originally that in Erpetogomphus ♂ ♀ the 10th joint was equal to the 9th. (*Mon. Gomph.*, table, p. 14 and p. 69.) In his latest word on the subject he says that in Erpetogomphus ♂ the 10th joint is equal to the 9th, but that

when it reaches half-way to the notum: under and rather behind the front wing, at the upper hind corner of the anterior pleural segment, a large, ill-defined, roundish, yellowish spot, in the same line with the yellow stripe. *Abdomen* long, robust, inflated at base, gradually contracted to the tip, with the hind edge of joints 2—5 narrowly yellow; venter brown. *Abdominal appendages* tipped with blackish, pilose. Viewed from above they are cylindrical, slightly contracted towards their base, slightly bent outwards at $\frac{1}{2}$ the way to their tips,

in *Erpetogomphus* ♀ "8—10 diminish successively in length," how much not being specified. (*Mon. Gomph.* p. 401.) In my *Erp. rupinsulensis* ♂, on the most careful measurement, 8—10 are respectively $3\frac{1}{2}$, $2\frac{1}{2}$ and 2 millimetres long, thus making joint 9 *three-eighths as long again as 10* in ♂ *Erpetogomphus*, whereas, according to M. Selys, joint 9 in ♂ *Erpetogomphus* is *equal to 10*. On the other hand, although M. Selys says that in *Ophiogomphus* "10 is half as long as 9," yet on measuring the ♂ ♂ of the two species of *Ophiogomphus* figured by Dr. Hagen, we find joints 9 and 10 to average respectively $7\frac{1}{2}$ and $4\frac{1}{2}$ millimetres. The difference between these proportions and those found in my ♂ *Erpetogomphus* is scarcely sufficient to afford a character of much subgeneric importance. If joint 9 in ♂ *Ophiogomphus* was proportioned to 10 as it is in my ♂ *Erpetogomphus*, it would measure a small fraction over $5\frac{1}{2}$ instead of $7\frac{1}{2}$ millimetres; and if joint 9 in my ♂ *Erpetogomphus* was proportioned to 10 as it is in ♂ *Ophiogomphus*, it would measure a small fraction over $3\frac{1}{2}$ instead of $2\frac{1}{2}$ millimetres. Such differences are practically worthless, as subgeneric characters.

After the above was in the hands of the printer, I received from Mr. A. S. Packard, jun., of the State of Maine, the following brief description of the ♀ of what is evidently an undescribed species of *Ophiogomphus*. Mr. Uhler had previously informed me that he had received from the same source an undescribed *Ophiogomphus*, which, so far as he recollected, was ♂. It will be noticed that it agrees with *Ophiogomphus* Selys, in the armature of ♀ occiput, and with *Erpetogomphus* Selys, in the thorax being chiefly green and in the vesicle of the vertex being divided into two tubercles. In the "Additions and Corrections" to the *Monographie*, however, M. Selys himself modifies the characters of *Erpetogomphus* by saying that "the six stripes of the front of the thorax may be pretty wide and blackish," (p. 431.) On the other hand the hind wing in ♀ of this species is 5.71 of the hind femur, according to Mr. Packard, while, according to the *Monographie* in *Ophiogomphus serpentinus* ♀ it is 3.88 of the hind femur. In *Erpetogomphus crotalinus* ♀, according to the measurements of the *Monographie*, it is 4.14, in *E. designatus* ♀ 5.58, and in *E. compositus* ♀ 6.00, or in the average of the three species 5.24, thus making the average hind femur of ♀ *Erpetogomphus* considerable longer, instead of shorter, than it is in this new species of *Ophiogomphus*. These additional facts prove, I think, conclusively that the subgenus *Erpetogomphus* must be suppressed.

Ophiogomphus mainensis Packard, n. sp. "♀ Green varied with brown. Front of the head green, pale and whitish in the neighborhood of the mouth. Vesicle of the vertex divided by a medial impressed line into two low tubercles,

about $4\frac{1}{2}$ times as long as wide, and at $\frac{2}{3}$ the way to their tips gradually tapering to a point which at the extreme tip becomes a small slender thorn. Viewed laterally, they are perfectly straight, slightly contracted towards their base and tapering towards their tips as before described. Superior anal process short, semicircular; the inferior larger but not extending further than the superior, triangularly slit to its base lengthways, very pilose and brownish. Vulvar lami-

and above somewhat cariniform. Occiput with two large transversely arranged tubercles behind, the bases of which occupy nearly the whole of its posterior surface, and which terminate each in a single sharp spine inclining a little forwards and surmounting its superior edge by a space equal to about one-fifth of its entire breadth, the two spines converging at an angle of about 60° , so as almost to touch at their extreme tips. *Thorax* mostly green, with brown lines and spots. The *abdomen* is very clavate, with segments 8 and 9 much dilated, 8 as broad as long, 10 one-half as long as 9, and it is of a dark color, with lateral, rather large, yellowish-brown or snuff-colored patches. *Legs* black.

Total length 1.80 inch [46 mill.] Front wing 1.25 inch [32 mill.] Hind wing 1.20 inch [31 mill.] Hind femur .21 inch [5 $\frac{1}{4}$ mill.] Hind tibia .15 inch [3 $\frac{3}{4}$ mill.] Hind tarsus .11 inch [2 $\frac{3}{4}$ mill.] Breadth of head .30 inch [8 mill.] One ♀. Common in the northern part of the State of Maine."

† The existence of the Asiatic subgenus *Macrogomphus* in North America rests solely upon my authority. The insect referred by me to that subgenus (*M. spiniceps* ♀ pp. 389—391) differs from the subgeneric characters laid down in the *Monographie* in a few unimportant points which I have specified, and two of which may now be erased from the list, for the following reasons:—1st. When M. Selys stated that *Macrogomphus* has *two subobsolete pale stripes on the dorsum of the thorax*, I carelessly misunderstood him to mean *two on each side of the dorsum*. My species has the number assigned by him to the subgenus, viz. one on each side of the dorsum or two in all. 2nd. I have already mentioned that the subgeneric character drawn from the protuberance on the middle of the ♀ occiput was subsequently allowed by M. Selys himself to be only of specific value.

I notice on the abdomen of certain specimens of *Mesothemis simplicicollis* Say, and of *Perithemis Domitia* Drury, irregular vein-like dark branches, very similar to those which I have recorded (p. 390) as found on the thorax of my unique *Macrogomphus* ♀. This of course confirms the opinion expressed by me (p. 383) that such markings are not markings of *external* coloration, but connected with the *internal* anatomy of the insect.

† The only known species of *Epigomphus* occurs in Brazil. The ♂ is unknown; but as the species agrees with *Macrogomphus* in the two very remarkable structural characters which I have given under the 2nd division in the Table, I have ventured to place it in the same category, though it is possible that its inferior abdominal appendages may not be divaricate. M. Selys seems more inclined to refer it to the same division as *Neogomphus*, though he places it in the body of his book immediately before *Macrogomphus*.

na scarcely 1.9th as long as the 9th ventral, very wide, emarginate at tip in the form of a circular arc 45° long, the emargination almost attaining its base. *Legs* rather paler than the body; tibiae with a superior yellow vitta; tarsal claws obfuscated. All four *wings* hyaline and marked alike, their extreme tips slightly clouded with fuscous, their veins black except the costal vein which is pale-reddish-brown, and the subcostal and median veins which are brown. The pterostigma, a square spot upon each of the second series of antecubitals narrower towards the nodus in the front wing, and a large irregular spot upon the nodus, all pale-reddish-brown. Both membranules white at base, fuscous at their extreme tip. Front wing, antecubitals 7, postcubitals 8; hind wing antecubitals 5, postcubitals 8. Discoidal areolets both before and behind 2—3, commencing always with 3. Total length including appendages 53 mill. Exp. 74 mill. Abd. $36\frac{1}{2}$ mill. Abd. appendages $2\frac{1}{2}$ mill. Front wing $37\frac{1}{2}$ mill. Its breadth 10 mill. Hind wing 38 mill., its breadth 13 mill. Hind femur $6\frac{1}{2}$ mill. Width of head $8\frac{1}{2}$ mill.

One mature ♀ only. Easily separated from all described N. A. *Cordulia* by the spots on the second series of antecubitals, which are suddenly darker on their basal and terminal edges so as to appear to be bounded by cross-veins.

It is with some misgivings that, in the absence of the ♂, I refer the above unique ♀ to *Cordulia*, although it agrees in its general appearance with the two species of that genus which I possess, and has the same short yellow pleural stripe enclosing the spiracle as *C. lateralis*, while its antecubitals and postcubitals are respectively 7 and 8, and those of *C. albicincta* 7—8 and 7—8. It seems to be perfectly congeneric with my two species, except that the color is not "brassy-green," but the exact shade of olive found in *Mesothemis corrupta* Hagen, and the vulvar lamina, instead of being very long, cleft nearly to its base, and almost attaining the tip of joint 10, is unusually short as in *Macromia*. It cannot however be referred to *Macromia* nor to *Didymops*, because the tarsal claws are normal and not equally bifid, nor to *Tetragoneuria*, Selys, (a genus which I do not know,) for the reticulation is not more dense than usual, neither are the cellules generally square as the name (*Tetragoneuria*?) seems to imply. Possibly it may belong to *Epithea*, the ♂ of which genus has in reality a very small and scarcely perceptible obtuse anal angle to the hind wings, apparently overlooked by authors, and a membranule no larger comparatively than in *Cordulia*, so far as I can see, though it is stated to be "large"; but in that genus too the vulvar lamina is long and bifid, extending to the tip of joint 9, and the only described

species is much slenderer than our insect, and has altogether a very different appearance. Does this insect belong to some genus of *Cordulina* not hitherto found in N. A.? or will it, when the ♂ is discovered, constitute a new genus? Of *Cordulia*, besides the five described species, there are no less than nine undescribed N. A. species in M. Selys' collection from Canada, Nova Scotia, &c., two of which *C. Franklini* and *Richardsoni* are said to be the representatives of the European *C. alpestris* and *arctica*. (Mon. Gomph. p. 78.) There can be no doubt that this insect belongs to *Cordulina*, because the posterior edge of the eyes is conspicuously tubercled.

To prevent misconception it may be stated here, that in all my measurements of the Odonatous body and abdomen the abdominal appendages are included, and that the width of the wings is measured, unless otherwise specified, at the widest place.

The character given on page 141 of the Synopsis to separate the *subfamily* Libellulina from the *subfamily* Cordulina, "beginning of the 2nd series of postcubital spaces with no transverse veins," should be stricken out and appended to the characters of the *Tribe* Libellulina, p. 132, for it is common to both subfamilies, Cordulina as well as Libellulina. The following Synoptical Table, compiled chiefly from scattered passages in the *Monographie des Gomphines*, *Mon. des Calopt.* and the *Synopsis N. A. Neur.*, briefly expresses the more obvious relations of the six subfamilies of the great Family Odonata. I have retained the systematic nomenclature employed by Dr. Hagen in the *Synopsis* for the sake of uniformity, though I agree with Leach in considering Odonata to form two distinct families, Agrionidæ and Libellulidæ—as it certainly must if we accept Prof. Agassiz's definition of the term "family"—the former including Dr. Hagen's subfamilies Calopterygina and Agrionina, and the latter his remaining four subfamilies. In the *Monographie*, on the other hand, Messrs. Selys and Hagen consider Odonata not as a *family*, but as a *suborder*, and Leach's two families they call tribes, and divide them into the three families Agrionidæ, Æschnidæ and Libellulidæ, which are again dichotomously divided into the same six subfamilies defined in the Synopsis by Dr. Hagen, except that instead of the termination *ina* they employ *inas* to designate the subfamily, as does also Prof. Baird in his work

on N. A. Ornithology. (*Mon. Calopt.* pp. 1, 2, and *Mon. Gomph.* pp. 1, 2.)

Here we may remark that, although the old established divisions of Kingdom, Sub-Kingdom (or Branch as Agassiz calls it,) Class, Order, Family, Genus and Species are employed by all modern Naturalists in same relative subordination, and have been beautifully and ingeniously defined by Agassiz, yet the term "Tribe" is used in very different senses by different modern systematists. For example, Dr. Hagen, as we saw above, considers the "Tribe" as intermediate between the "Family" and the "Subfamily"; the authors of the *Monographie* and Prof. Baird consider it as intermediate between the "Suborder" and the "Family"; and modern Coleopterists consider it as intermediate between the "Subfamily" and the "Genus." (Leconte *Introd. Class. Coleop. passim.*) It is very desirable that the meaning of this and similarly indefinite terms should be settled with precision, and also that some peculiar termination should be adopted universally for every systematic subdivision. Probably this could only be effected by the action of a Scientific Congress. Individual authors, Prof. Baird for example, are already aiming at it, but there is a lack of unanimity amongst them. Without some such technical assistance it is every day becoming more impossible for the human memory to grasp the infinite multiplicity of modern scientific analysis. When Dr. Hagen, for example speaks simply of Agrionina, who is to tell, except by guessing from the context, whether he means the *tribe* Agrionina or the *subfamily* Agrionina? And so in Coleoptera, when Dr. LeConte speaks simply of Carabidæ, who is to tell, with the requisite scientific precision, whether the *family* Carabidæ or the *subfamily* Carabidæ is referred to?

SYNOPTICAL TABLE OF THE SUBFAMILIES OF THE
FAMILY ODONATA.

		SUBFAMILIES
1st Tribe. AG- RIONINA. Wings alike, vertically fol- ded in repose. (Eyes remote and pedunc- led.)	Antecubital cross-veins numerous, at least five in number. (Wings almost always not petiolated.)	1. CALOPTERYGINA.
	Antecubital cross-veins two only. (Wings always distinctly petiolated.)	2. AGRIONINA.

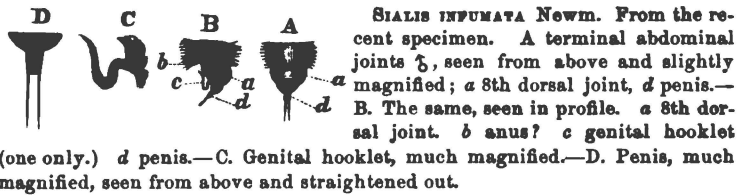
Hind wings differently shaped from front wings; all 4 wings carried horizontally in repose.	2nd Tribe. ÆSCHNINA.* Antecubitals of the 1st & 2nd series not corresponding except at base. Base of the 2nd series of post-cubitals with cross-veins.	Eyes ♂ ♀ remote, or touching at a single point (<i>Cordulegaster</i>), the touching part of each forming an acute angle.	3. GOMPHINA.
		Eyes ♂ ♀ touching for a considerable space, the touching part straight, or at a single point (<i>Æschna heros</i>), the touching part rounded in a regular curve.	
	3rd Tribe. LIBELLULINA. Antecubitals of the 1st & 2nd series corresponding. Base of the second series of post-cubitals with no cross-veins.	Each eye laterally tubercled behind.	5. CORDULINA.
		Posterior edge of each eye simple.	6. LIBELLULINA.

M. Selys says that the character drawn from the arrangement of the eyes "is the only one which effectually separates Gomphina from *Æschnina*;" (*Mon. Gomph.* p. 4) and in separating these two tribes, (p. 2) he defines Gomphina as "having the eyes remote one from the other or touching only in a single point (*par un point seulement*)," though under the genus *Cordulegaster* he adds that the eyes of that genus are "transverse." (*Mon. Gomph.* Table p. 310.) After intimating that in *Æschna* the eyes do also touch, he winds up by suggesting that "we should not consider this character in too critical a manner (*d'une manière trop minutieuse*)."^{*} So strongly had the difficulty of separating *Æschnina* from Gomphina been felt, that Bur-

* M. Selys lays down as a character of the family *Æschnidae*, that "the discoidal triangles of all four wings are constructed in an analogous manner"; (*Mon. Gomph.* p. 2), and Dr. Hagen states of his 2nd Tribe *Æschnina* (= *Æschnidae* Selys) that "the triangles of all the wings are of the same form." (*Synops.* p. 98.) There are exceptions to this rule in Gomphina. In the genera *Gomphoides*, *Chlorogomphus*, *Petalura* and *Phenes*, the triangles of the hind wings are quite dissimilar to those of the front wings. (*Mon. Gomph.* Plate 23 &c.) In all *Libellulina* known to me the triangles of the hind wings are either dissimilar, or dissimilarly situated to those of the front wings. (See *Hag. Synops.* p. 132.)

meister and Vander Linden actually annexed the troublesome genus *Cordulegaster* to *Æschnina*, so as to cut the knot instead of untying it, although, as M. Selys well observes, that genus has manifestly the general characters and the coloration of *Gomphina*, and in some of its subgenera the eyes do not quite touch. I have endeavored—I know not with what success—to define with precision wherein the distinction between the eyes of *Gomphina* and *Æschnina* consists. In the *exotic* genus *Petalia*, which belongs to *Gomphina*, the eyes touch, but the touching part is figured as scarcely angulated, especially in the subgenus *Phyllopetalia*. (Mon. Gomph. Plate 18, figs. 7 and 8.) So far as *N. A.* genera are concerned, the distinction laid down in the Table is undoubtedly correct.—In the *Tribe Libellulina* there are often one or two supernumerary cross-veins in the 1st or 2nd series of antecubitals, either in the middle or at the tip of the series, which of course cannot “correspond” with any cross-veins in the other series; but the other cross-veins always “correspond,” i. e. are not “dislocated” as Say expressively terms it in *Hymenoptera*. In the tribe *Æschnina* they are all “dislocated” except at the base and a single robust pair not far from the base.

SIALINA.



SIALIS INFUMATA Newm. From the recent specimen. A terminal abdominal joints ♂, seen from above and slightly magnified; *a* 8th dorsal joint, *d* penis.—B. The same, seen in profile. *a* 8th dorsal joint. *b* anus? *c* genital hooklet (one only.) *d* penis.—C. Genital hooklet, much magnified.—D. Penis, much magnified, seen from above and straightened out.

Note 25, p. 180. The above drawing represents the position assumed by the parts when the middle of the abdomen is slightly compressed. The last ventral, to the tip of which the genital hooklet (*c*) is attached, when viewed from below has on each side of its disk a large round fovea, and underneath the lobed tip (*b*) of the 7th ventral is a very large triangular cavity directed forwards, which is probably the anus. The whole is black, except the hooklet which is piceous but paler at base and tip. I am not certain whether the piece succeeding *a* is to be considered as a ninth dorsal or as the basal joint of the penis, but

I rather think the latter, as the ♀ abdomen is distinctly 8-jointed. It is opaque black, not shining black like the piece behind it.

In ♀ the dorsal and ventral pieces of the 8th or terminal joint of the abdomen are separated by an opening, which, when viewed in profile, is obtrigonal, the dorsal piece being very large and somewhat pyriform, the large end at the tip, and more than twice as long as the ventral, and the ventral being triangular. Viewed from below the 8th ventral is semicircular, and split lengthways to its base.

The species occurs near Rock Island plentifully, but only on the banks of the Mississippi. *Sialis americana*, on the other hand, occurs more sparingly, and exclusively on the banks of Rock River, the two rivers being only 2 or 3 miles apart.

Note 26, p. 181. CHAULIODES LUNATUS Hag., and SERRICORNIS Say. The "inferior appendage" spoken of by Dr. Hagen is not, unless I mistake, the homologue of the true inferior appendages but of the lobe attached to the tip of the penultimate ventral joint in ♂ *Sialis*. (See fig. B, b.) It exists just as he describes it in *lunatus*, in a specimen of that species sent to me by Mr. Uhler, the sex of which however is uncertain because it has lost its antennæ, but is manifestly attached to the penultimate ventral. Throughout Neuroptera, Pseudoneuroptera and Orthoptera the true ♂ inferior appendages, whether soldered together as in the Tribes *Æschnina* and *Libellulina*, or free and prehensile as in the tribe *Agrionina*, are always, when they exist at all, placed behind the last ventral. In my ♂ specimen of *C. rastricornis* this appendage has apparently been obliterated by stuffing the abdomen with cotton. If we refer to the closely allied genus *Corydalis*, we shall find that the true inferior ♂ appendages are two in number, wide apart, long, forcipate, and freely moveable as in *Agrionina*, though they are anomalous in being attached not to the sternal piece of the venter but to what may be called the pleura of the last abdominal joint, which is separated from the dorsal piece of that joint by an indistinct suture. It might be thought that this entire piece, both dorsum and pleura, was the homologue of the superior appendages, and the pieces which I consider as the true inferior appendages were mere branches of those appendages, but for the fact that the preceding joint ♂ ♀ bears a distinct spiracle in its lateral membrane and cannot therefore be the last abdominal joint. Both in ♂ ♀ *Chauliodes*, so far as can be seen

in the dried specimen, there appear to me to exist two pair of very short, robust appendages similarly situated to those of *Corydalis*, the superior pair slightly incurved and prehensile in ♂ and simple in ♀, and the inferiors simple ♂ ♀. In *Corydalis* both pairs of appendages are long and strongly forcipate in ♂ and short and simple in ♀.

Note 27, p. 181. CHAULIODES RASTRICORNIS Ramb. I have bred many specimens of this insect from the larva, which occurs under the loose bark of floating logs, apparently beneath the surface of the water, and retires under logs &c., on the dry land to assume the pupa state, forming a rude cell there as does *Corydalis cornutus* L. Sometimes on floating log-rafts it forms its cell under that portion of the bark which is permanently above water. The pupa is quiescent, but has the power, when disturbed, of crawling along quite fast on its belly. It lies in the pupa state about 3 weeks, and my first imago appeared May 28.

The larva is of a pale dingy brown color, and has the general appearance of that of *Corydalis cornutus*, but is much smaller measuring only 40—45 mill., exclusive of the abdominal appendages. The *Head* is subquadrate, not wider than the prothorax and with no neck such as that of *Corydalis*, piceous, glossy and with a few scattered punctures. The mouth scarcely differs from that of *Corydalis*, except that the epistoma and labrum are larger and the latter proportionally much wider, and except also that the mentum is longer and its emargination is truncate-obtrigonal, instead of describing a circular arc of 90°. Precisely as in *Corydalis*, the maxilla is elongate, depressed, four times as long as wide and with its sides parallel, and as in *Corydalis*, it is remarkable for being furnished at its tip with two palpiform appendages, the outer one a little the longer of the two and nearly as long as the maxilla is wide. The outer one or true palpus, is more robust than the other, 4-jointed, the last joint very minute; the inner one, (the homologue of the Orthopterous galea and of the palpiform outer maxillary lobe in the Coleopterous Adephaga,) is distinctly 2-jointed, the basal joint the stoutest and the two of equal length. Although in *Corydalis* the eyes are lateral, 6 in number, simple of course, and very distinct, yet in *Chauliodes* they are scarcely perceptible and cannot be counted. The antennæ are about 2 mill. long, 5-jointed, the joints each slenderer than the preceding one and proportioned to each other as follows:—1, 3, 1,

1, 1; whereas in *Corydalis* they are 1, 3, $2\frac{1}{2}$, 2, $1\frac{1}{2}$. The *pronotum* is subquadrate, with the prothoracic spiracle behind its posterior corner, as in *Corydalis*; the meso- and metanotum are each 3 times as wide as long; all three corneous, glossy, piceous mottled with luteous and with a few scattered punctures, whereas in *Corydalis* it is only the pronotum which is glossy and corneous, the other two segments being almost as opaque as the abdomen. The *abdominal* joints are opaque, eight in number only, joint 1 half as long as each of the rest which are subequal. Joints 1—7 have each a lateral, subterminal, exarticulate, fleshy seta nearly at right angles to the body and about as long as the body is wide, immediately above and behind which is the spiracle which is very distinct; joint 8 has the same seta as the rest but no spiracle. In *Sialis*, on the contrary, the lateral setæ are said to be articulate and have been supposed to act as branchiæ. Upon the dorsum of each joint, a little before the middle, is a very distinct transverse suture, and behind it at regular intervals two others less distinct, indicating apparently the normal subsegments. From the tip of the last segment there proceeds a pair of appendages, contiguous, and exactly similar to those of *Corydalis*, viz., a robust fleshy pillar, more than half as long as one of the abdominal joints, at the tip of which is a pair of long, curved, horny, shining claws above, and a fleshy, tapering seta below twice as long as the claws. Above these two appendages is a pair of robust, fleshy, exarticulate setæ, similar to those of *Acheta*, but closely contiguous and tapering much less rapidly, $\frac{1}{2}$ millimetre in diameter at base and probably at least 10 or 12 millimetres long, the unbroken portion in my specimen measuring 6 millimetres. Legs dark luteous; the tarsi one-jointed and as long as the tibiæ, with no appearance of any sutures and with two terminal claws.

Besides the points above specified this larva differs from that of *Corydalis* in three other respects: 1st, *Corydalis* has a 9-jointed, not 8-jointed abdomen, 1—8 having the same lateral seta and spiracle as 1—7 in *Chauliodes*, and 9 having neither seta nor spiracles. 2nd, *Corydalis* has no caudal setæ, nor even any rudiments of them, so that *Chauliodes* forms a connecting link in this respect between that genus and *Sialis*, the larva of which is said to have "one long, slender, setose tail." (Westw. Intr. II, p. 50.) 3rd, the venter of *Chauliodes* is simple, and entirely destitute of the remarkable paddle-like branchiæ found in *Cory-*

alis on joints 1—7 under and before the lateral setæ, no traces of them being discoverable even in the living larva.

The pupa, or at all events the ♀ pupa, has two robust obtuse abdominal appendages, confluent towards their base and about two mill. long, and an inferior process of two similar ones which are connate throughout. The antennæ are multiarticulate and longer than the head, and the tarsi are 5-jointed. In its general appearance it resembles the pupa of *Sialis*.

Note 28, p. 182. CORYDALIS CORNUTUS L. A most respectable man, who keeps the toll-bridge over Rock River where this insect is very abundant, informed me that on several occasions its larvæ had fallen down one of his chimneys. His idea was that they must have bred there; but that of course is out of the question. The statement was confirmed by his wife and I have no doubt of its truth. In 1863 I threw a larva of this insect into the Mississippi to examine into its customary mode of progressing in the water, which, as I found, was by crawling along the bottom not by swimming. As it emerged from the water, it climbed with ease up the stump of a large white elm, which was stripped of its bark and as smooth as any carpenter could have planed it. The stump was three feet high and upright, and when it had reached the top it commenced descending on the opposite side, but after a while lost its foothold and fell into the water again. The pair of 2-clawed appendages at the tail are used with much effect to assist it in climbing. The building which it must have climbed to reach the chimney, down which it is stated to have fallen, was only a low one-story wooden one. I learnt from the same source that these larvæ are nocturnal in their habits, for, though they are never seen travelling by day, they had several times been noticed running about in the dawn of the morning. Some which I bred to the imago state in 1861 never commenced travelling till after nightfall, and when thrown into a basin of water swam with vigor. They are much sought after as fish-bait, having a very tough integument so that one larva suffices to catch several fish, and are popularly known in the neighborhood of Rock Island as "crawlers." The larva, after it has left the water, retires under a stone or log or plank to hide during the day, and finally to change to the pupa state, and forms there an irregular cell in the earth. The pupa of the ♀, or what I take to be that of the ♀,

has two excessively robust superior appendages, incurred so that their extreme tip points backwards, with a rudimental intermediate appendage, and two excessively robust straight inferiors half as long as the superiors, basally confluent with them, and occupying the entire ventral surface. It is several weeks before the imago of *Corydalis* emerges, which is nocturnal in its flight, as is also that of *Chauliodes*, and dull and sluggish in its motions.* It is greedily devoured by birds and domestic fowls, as is also the larva whenever they can meet with it. The eggs are deposited in patches, as I am told, upon any substance overhanging the water. This insect occurs both on the Mississippi and on Rock River, but most abundantly in those localities where there is a rocky bottom. I have never met with it in the larva state more than a hundred yards from the water.

Note 29, p. 182. *MANTISPA BRUNNEA* Say. I do not possess this species, but I have taken near Rock Island a single pair of the rare *M. interrupta* Say, which is stated by Mr. Uhler to exhibit the same "tarsal lobes" as the other species. On the closest examination I can detect no traces of any lobes on the tarsi, except the two lobes of the large pad or onychium under the tarsal claws of the 4 hind feet, which lobes are alike in both sexes and obvious on every tarsus, exhibiting in several of them both ♂ and ♀ a slight appearance beneath of pale hyaline membrane. The "quadrate fuscous spot" on the wings of *M. interrupta*, spoken of by Mr. Say, is represented in both my specimens by a ferruginous bordering of one of the cross-veins springing from the costa, and the costa in my specimen is bright ferruginous as Say describes it, not "fuscous," as it is described in the Synopsis. Is not Dr. Hagen's insect a distinct species? It disagrees with Say's description in many respects. Mine agrees exactly, except in the color of the "quadrate spot" above referred to.

Since the above was in the hands of the printer, I have learnt from Mr. Uhler that his remarks in the *Synopsis* refer to the *plantula* (*onychium*) not to the appendages described by Dr. Hagen, which, at

* Mr. E. T. Cresson informs me that "he collected a large number of ♂ *Chauliodes serricornis*? Say on the wing about 10 or 11 A. M. on a clear, warm day in June." Myrmeleon is generally said to be nocturnal in its flight, but the only two pairs I ever took (*M. salvus* Hag.) occurred on the wing in broad daylight.

the time when his (Mr. Uhler's) remarks were printed, were, as he says, unknown to him. He adds that "these appendages cannot be characteristic of sex as Dr. Hagen supposes, because *most specimens* are not furnished with them." This last proof seems to me no proof at all. To make it conclusive, it ought to be shewn in addition that these appendages occur *both in ♂ and ♀*. Of course, Mr. Uhler's statement that these appendages are also found in *M. interrupta* applies to the *onychium*, and it is no wonder that I could not find them in that species either ♂ or ♀.

APPENDIX.

Heterina scelerata n. sp. (= *H. americana* Walsh, p. 210.)

After the preceding pages were in press, Mr. Uhler was kind enough to send me at my request a pair ♂ ♀ of *H. americana*. On comparing the ♂ abdominal appendages with those of the ♂ described page 210, and doubtfully referred to *americana*, I am satisfied that this doubtful ♂ is a distinct and undescribed species (*scelerata*) for the following reasons:—1st. In *americana* the laminiform medial tooth of the superior ♂ appendage has its sides convergent at an angle of about 45° for about two-thirds of its entire length, the terminal third part being rounded in a flattish or obtuse curve. In *scelerata* the sides of this tooth, instead of converging rapidly, are almost parallel for two-thirds of its entire length, but the terminal third part is rounded as in *americana* except that it is of course much wider. In both species the tooth is directed inwards and downwards and a little forwards, so that its true shape is only seen when viewed laterally in an oblique direction from above or below. Viewed either perpendicularly from above, or horizontally in profile, as in Dr. Hagen's drawings of *americana* (Monogr. Calopt. Plate XII, fig. 3,) its proportions are foreshortened and altered. I find that the stray abdomen mentioned above page 212, and supposed to belong to *basalis*, has the laminiform tooth of the superior appendage identical with that of *americana*, viz. triangular with the apex truncate and obtusely rounded. 2nd. In *americana*, on the upper surface of the posterior base of this laminiform tooth, there is nothing but a slight intumescence, which on a cursory inspection would scarcely be noticed; in *scelerata*, as already stated page 211, there is a distinct hemispherical tubercle there, which is colored fuscous with the

surrounding space yellowish.—Coupled with the colorational distinctions already noticed in the wing-spots and the pterostigma, (page 211,) these two structural differences are manifestly of specific value. In the second ♂ *americana* received from Mr. Uhler, the carmine-red basal spot extends only 3—4 cellules beyond the quadrilateral in the front wing, and $1-1\frac{1}{2}$ in the hind wing, instead of 5 and 3 as in the first ♂; thus increasing still further the disparity in this character between *americana* and *scelerata*, where it extends 11—12 and 8—9 cellules beyond the quadrilateral. The laminiiform tooth of *scelerata* is shaped nearly as in *pseudamericana*, but is much smaller, being only about $\frac{1}{4}$ as wide at base as the appendage is long, instead of $\frac{1}{2}$.

Mr. Uhler, to whom I had communicated my observations on the whitishness of the principal sector beneath in *pseudamericana* and *texana*, says that he "has captured many pairs of *americana* in copula, and that the teneral [or very immature] ♂ has the underside of the principal sector very conspicuously whitish, just as in the teneral and less adult ♀. In this state the dorsum of the thorax and abdomen is bright emerald green ♂ ♀; in the adult ♂ it is splendid coppery purple and in the adult ♀ olive-greenish. In the semi-adult ♂ and the adult ♂ ♀ the principal sector inferiorly is brown, or at most not whitish. In the teneral ♂ the pterostigma is whitish; in the adult ♂ brown."* —In the two ♂ *americana* sent me by Mr. Uhler himself, which are both adult, the principal sector and the other veins described as yellowish white in *pseudamericana*, are not "brown," but *black* beneath, and they are described as black in the *Monographie* both in the adult ♂ and the semi-adult ♂, (jeune ♂.) In the ♀ *americana* recently received from Mr. Uhler, which is tolerably mature and has the dorsum of the thorax dark green, the principal sector &c., are reddish-brown beneath. In this ♀ there are on the postcosta of the front wing only 2—3 irregular ranks of cellules, instead of 3—5 as in *pseudamericana* ♀; and the front wing is 28 mill. long and $4\frac{1}{4}$ mill. wide at the nodus, instead of $32\frac{1}{2}$ and 6, (or proportionally half a millimetre wider,) as in *pseudamericana* ♀. Hence the abnormal ♀ referred above doubtfully

*The description in *Monogr. Calopt.* (p. 133) says that the pterostigma of the adult ♂ is "reddish brown," and that of the semi-adult ♂ "yellow." In the remarks following that description, the ♂ pterostigma is erroneously stated to be "yellow," without regard to age.

to *texana*, which likewise has only 2—3 ranks of cellules on the postcosta of the front wing, and in which the proportions of the front wing are 30 and 5, may not improbably belong to *americana*. If proportioned exactly as in *americana* ♀ the front wing would be 5.09 mill. wide.

As I still think from the structure of the postcosta of the front wing, and the greater comparative breadth of that wing, that the ♀ formerly sent me by Mr. Uhler as ♀ *Americana* belongs to *pseudamericana*, it is probable that both these two species exist in Mr. Uhler's neighborhood, and that he may have partially confounded the two together in his description of the former. I doubt the fact of the principal sector &c. in ♂ *americana* being "whitish" beneath in the teneral individual, as stated by Mr. Uhler, when I see with my own eyes that it is perfectly black, not brown, in the adult specimen. Still, coloration in Agrionina is so variable, that it is difficult to fix the limit of variation.

It will be observed that, according to Mr. Uhler, it is only the teneral ♂ and the teneral and semiadult ♀ ♀ of *americana* that have the principal sector &c. whitish beneath; whereas in *pseudamericana* ♂ ♀ and *texana* ♂ the adult specimen also has these veins whitish beneath. *Pseudamericana* ♂ differs also both from ♂ *americana*, ♂ *scelerata* and ♂ *texana*, in the tubercle behind the laminiform tooth (not the one on its superior base) being only about $\frac{1}{4}$ as wide as that tooth, instead of about $\frac{1}{2}$ as wide as in *americana* and *scelerata*, or $\frac{1}{4}$ as wide as in *texana*.

On p. 217 I said that "in Gomphus there are normally two dark stripes on the pleura, one on the mesothoracic epimerum and one on the metathoracic episternum." The *locus* of the latter is, correctly speaking, on the anterior suture of the metathoracic episternum, or, in other words, on the suture dividing the meso- from the meta-thorax.

In many, perhaps all, Agrionina and Calopterygina, (Agrion, Lestes, Calopteryx, Heterina, Libellago, &c.) there exists behind the humeral suture a more or less developed supernumerary or false pleural suture dividing the mesothoracic epimerum into two subequal parts, the posterior part bearing the spiracle. Slight traces of this suture are occasionally found in the other four Odonatous Sub-families. The *Mono-*

graphie calls this supernumerary suture the *first* pleural suture, that dividing the mesothorax from the metathorax the *second* or median suture, and sometimes "the suture under the wings." and that behind the metathoracic episternum the *third* or sometimes the ventral suture. (*Mon. Calopt.* p. 11.) Considering this false or supernumerary suture as a true one, it is a remarkable fact that in Gomphus the *locus* of each dark pleural stripe is always *in or on a suture*, and in Hetærina *between two sutures*. But as if to show how Nature never proceeds by sudden leaps, there exists in many Hetærina, in addition to the normal dark stripes *BETWEEN* the sutures, a short black line at the upper part of the pleura *IN* one or two of the sutures.

Strictly speaking, there are typically *three*, not *two*, dark pleural stripes in Gomphus. For example, in several Onychogomphus (groups *geometricus* and *grammicus* and certain species of the group *cognatus*.) in Ceratogomphus, and in one single species of Gomphus, *G. parvulus*, there is said to exist a *third* dark pleural stripe "on the posterior border" of the metathorax or "on the third suture." (*Mon. Gomph.* pp. 16, 18, 19, 66, 77, 158.) In *Gomphus melsénops*, *G. minutus* and *G. occipitalis* the *Monographie* especially notices the absence of this third pleural stripe, (pp. 129, 156, 166.) Just as in *G. kurilis* the *first* dark pleural stripe is obsolete, and in *G. fraternus* and a few other species the *second* dark pleural stripe is almost always obsolete, so in all 37 Gomphus, except *parvulus*, and in many other subgenera of the great genus Gomphus, this *third* pleural stripe is obsolete. In *Platygomphus* the pleural dark stripes are all three of them obsolete. In *Erpetogomphus boa* Selys, and *E. rupinsulensis* Walsh, not only are all the three typical dark pleural stripes obsolete, but also the three typical dark stripes on each side of what is called the dorsum of the thorax. In the other species of *Erpetogomphus* these last are only subobsolete. The important point to observe is, that wherever any of these dark thoracic stripes exist, their *locus* is definitely fixed.* So that if we believe that each species of, e. g., the 37 described species of Hetærina and of the 86 described species of Gomphus was separately created, and not derived by hereditary descent from some one

* Dr. Hagen well observes of the extra-American Legion *Lindenia* (Gomphina) that "by fixing the primitive designs [of the thorax], we may always derive from them the special variations." (*Mon. Gomph.* p. 251.)

primordail form, we are compelled to believe that the Great Author of Nature, for some inscrutable purpose, confined himself in ornamenting each species of these two extensive genera to mere modifications of one single design or pattern. A human artist who should so confine himself would be immediately accused of poverty of imagination.

ILLINOIS PSEUDONEUROPTERA.

	OLD SPECIES.	N. SP. 1862. (B. D. W.)	N. SP. 1863. (B. D. W.)	TOTAL.
TERMITINA. . . .	1	0	0	1
PSOCINA,	5*	6	7	18
PERLINA,	9†	9	0	18
EPHEMERINA, . . .	10	16	5	31
AGRIONINA, . . .	12	4	4‡	20
ESCHNINA,	8	6	3	17
LIBELLULINA, . . .	21	2	1	24
TOTAL,	66	43	20	129

ERRATA.

Page 177, line 12, for "basal" read "tarsal."

" 217, line 6 from bottom, for "metathoracic episternum" read "anterior suture of the metathoracic episternum."

" 238, line 21, for "varies" read "differs."

" 246, line 17, for "agree with those" read "agrees with that."

" 252, line 11, for "stated have" read "stated to have."

" 259, line 6, for "same" read "the same."

* Exclusive of *Ps. lichenatus* and *Ps. abruptus* = *corruptus*.

† Including *Nemoura albidipennis* (p. 188).

‡ Exclusive of *Heterina texana* n. sp., from Texas, but including *H. scelerata* n. sp.

The following Errata and Corrigenda may be noticed as occurring in my Paper in Proc. Acad. Nat. Sciences of Philadelphia:—

- p. 361, line 15, for "(South Illinois)" read "(North and South Illinois)."
- p. 364, line 3, for "length ♂" read "length ♂ abdomen."
- p. 365, dele line 18 "no appearance of any suture."
- p. " dele lines 6—4 from bottom, repeated from lines 15—13 from bottom.
- p. 371, line 27, dele "except the last segment."
- p. 376, line 23, for "Alar exp. ♀" read "Alar exp. ♂."
- p. 381, lines 17 and 21, for "*undata*" read "*fluctuans*."
- p. 383, last line, for "behind" read "before"
- p. 387, line 27, for "triangular brown spot" read "triangular spot, brown."
- p. 393, Table, line 3, for "long, slender, yellowish" read "absent."
- p. " " line 4, for "yellow?" read "yellow, banded with black."
- p. 394, line 20, for "quadrangular" read "rectangular."
- p. 397, Table, last line, for "3½" read "31½."
- p. " line 6 from bottom, for "two inside" read "two inside;"
- p. 401, 1st column, line 15 from bottom, for "—13 sp." read
 "*Isopteryx cydippe* Newm.
 Capnia minima Newp.
 Tæniopteryx fasciata Burm.
 Nemoura completa Walk.
 —17 sp."
- p. 401, 2nd column, line 15 from bottom, for "binotatum" read "binotatum n. sp."
- p. 402, 2nd column, line 6 from bottom, for "Perlina - - - 13 - - - 19" read
 "Perlina - - - 17 - - - 9."
- p. " 2nd column, last line, for "106" read "110."

Rock Island, Illinois, Sept. 21, 1863.