

THE
ZOOLOGIST:
A
POPULAR MISCELLANY
OF
NATURAL HISTORY.

CONDUCTED BY
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APPENDIX

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ART. XXIX. — *Proposed Division of Neuroptera into two Classes.*
By EDWARD NEWMAN.

CHARACTERS are assigned to groups in Natural History, for the purpose of distinguishing them from other groups. To accomplish this end, characters should apply to all the component parts of the groups which they are intended to distinguish, and should *not* apply to the component parts of any cognate group which they are not intended to distinguish. It is, however, no proof that a group is unnatural, because the characters which naturalists have assigned to it are insufficient; for the uninstructed mind acknowledges Nature's grouping, without the aid of science: an infant will distinguish a bird or a fish, without knowing the characters which separate both from a mammal; and however the man of science may blunder in defining those characters, however unsatisfactory to himself and to others may be his definitions, still a bird and a fish will ever be recognized as things distinct and separate from each other and from mammals. Nothing is more certain than that Nature has distinguished such groups: nothing is more probable than that man should fail in defining them. In Entomology, we have hit on distinguishing characters for most of the classes; but that which is now universally known by the name Neuroptera, and, by a few entomologists, by my proposed name of Anisomorpha, has defied all attempts at definition, except such vague and negative definition as depends on variation or absence of character. Moreover, the mind does not recognize Neuroptera as one of Nature's divisions. All our systematists have felt this deficiency, this difficulty; but instead of carefully revising the entire group, and

endeavouring to re-arrange and harmonize its contents, they have cut off here and there a group which appeared to them peculiarly aberrant, thinking that they had thereby reduced the residue into a more homogeneous mass. Our most profound systematists have thus separated groups from the Neuroptera, and raised them to an equal rank with the heterogeneous residue, which they have left united. As instances I may mention De Geer, Fabricius, Dumeril, Kirby, MacLeay, Haliday, Brullé, Laporte Count de Castelnau, &c., who, under the names of Elinguia, Odontata, Stegoptera, Trichoptera, Megaloptera, Thysanoptera, Isoptera, Raphioptera, Anisoptera, &c., have separated one or other of the integral portions of the class. To criticise the labours of the men whose names I have here enumerated, would be altogether out of place in one who is proud to rank himself as their disciple; but it cannot be overlooked that the concurrent testimony of these profound and original thinkers is against the integrity or homogeneity of Neuroptera, although each has sought a different remedy for an evil equally manifest to all.

My own idea, broached many years ago, is, that the character of variety in structure and metamorphosis, which all have assigned to the Neuroptera, and which, for want of a better, I must leave attached to the Anisomorpha, is not only insufficient but unphilosophical; and though still at a loss to find satisfactory characters for the imago, I think there is no doubt that the varied metamorphosis affords the means of dividing the group into two good and equal divisions. That these divisions should not be of the same extent as the other classes of Tetraptera, indeed, that they should be more intimately related, and should possess a great and structural resemblance in the perfect state, appears to me in no way to militate against the necessity for their separation, but simply to establish their central position among Tetraptera, a subject which it is not the object of the present paper to discuss; neither do I consider it needful to explain away the addition of an eighth division to this important group, although I am thus setting aside, at least to all appearance, the prevalence of the number seven. The following formula is that which I now beg to offer to the notice of entomologists, as desirable to adopt in this division of Entomology.

INSECTA TETRAPTERA.

Pupa amorphous	AMORPHA.
Wings normal, scaly	LEPIDOPTERA.
Fore wings normal, hind wings abnormal, club-shaped	DIPTERA.

Pupa necromorphous	NECROMORPHA.
Wings normal, naked	HYMENOPTERA.
Fore wings abnormal, coriaceous ; hind wings normal, folded.....	COLEOPTERA.
Pupa isomorphous	ISOMORPHA.
Mouth mordent, with transversely moving jaws	ORTHOPTERA.
Mouth with its component parts setiform, fitted only for imbibing fluids	HEMIPTERA.
Pupa various	ANISOMORPHA.
Pupa isomorphous.....	NEUROPTERA.
Pupa necromorphous	STEGOPTERA.

The following additional characters of the two new classes are offered in further elucidation of their distinguishing differences ; and it may be observed that they are subject to occasional exceptional modifications.

NEUROPTERA, *Newm.*, non *Linn.*

Larva hexapoda ; *agilis* ; mordens ; Ephemeris, Agrionibus, Libellulis, Perlis, aquatica, rapax, entomophaga ; Termitibus, Psocis, Thripibus, terrestres vel arborea, plerumquè phytophaga.

Pupa *propemodum isomorpha* ; hexapoda ; *agilis* ; *natat, currit, vorat.*

Imago *larvam plus minusve simulans* ; alis 4 amplis, membraneis, *nudis*, paribus ; Ephemeris, Agrionibus *erectis* ; Libellulis *porrectis* ; mandibulis corneis, plerumquè validis, mordentibus.

STEGOPTERA, *Newm.*, non *Dum.*

Larva hexapoda ; *segnis* ; mordens ; Phryganeis, Corydalibus, aquatica, ? phytophaga ; Myrmeleonibus, Hemerobiis terrestres vel arborea, rapax, entomophaga.

Pupa *necromorpha* ; *pelliculo ligata* ; *sine ore, sine motu* ; *neque natat, nec currit* ; *folliculo serico diù quiescit.*

Imago *larvam nullo modo simulans* ; alis 4 amplis, membraneis, plerumquè hirsutis, paribus, *neque erectis, nec porrectis, sed convolutis aut decumbentibus*, corpus tegentibus, instar tecti ; mandibulis plerumquè corneis, plerumquè mordentibus.

A few additional observations may serve still further to illustrate the differences between the two classes. In the first place, the metamorphosis is decidedly different : the pupa in the Neuroptera is uniformly locomotive and feeding, in the Stegoptera uniformly quiescent

and incapable of feeding: the much-discussed exception in the instance of *Raphidia ophiopsis* is apparent, and not real; in this insect there is no cocoon, and the pupa inhabits exactly the same situations as the larva, namely, excavated passages in the decayed bark of trees; it moves after a fashion, but only in the same way that the pupa of a *Hepialus* or an *Ægeria* may be said to move; and in each of the three instances the character, as regards the tribe, is exceptional, and not distinctive. The pupa in the Neuroptera, on the contrary, is uniformly active and voracious, although not uniformly isomorphous; the squat toad-like pupa of the Libellulina being very unlike the elegant imago. Natural classification is tripod, and metamorphosis, alary structure and cibarian structure are the three legs on which it stands: to neglect metamorphosis, therefore, where so decidedly marked as in the present instance, were to undermine the entire edifice, and to endanger the stability of the building. The flight, again, in the typical Neuroptera is pre-eminently strong and long-continued, gradually failing in aberrant orders, and perhaps becoming totally extinct among the most aberrant of all, the Thripsina: in the Stegoptera the flight is generally of short duration, heavy, fluttering and laboured, and the more strongly marked the characters of the class, the more feeble are the powers of flight. Again, as to food: the conspicuous and numerically preponderating Libellulina in the Neuroptera are predaceous and voracious in an eminent degree; whereas the equally well marked and equally numerous Phryganeina, in the Stegoptera, not only are not predaceous, but are not known to take any food: and when we find the Stegoptera exhibiting a predaceous and raptorial structure, as in Raphidiina and Mantispina, such characters are associated with the assumption of other Neuropterous characters, as the nude, hyaline, glittering, and strongly reticulated character of the wings, and the nudity of the pupa. These considerations lead to the belief that the Neuroptera and Stegoptera are distinct but proximate classes. In addition to these observations, it seems desirable to explain that these classes, although bearing old names, are nevertheless totally new. I feel an absolutely insuperable objection to giving new names where old ones can by any ingenuity be made to answer the purpose; and although I take on myself the responsibility of the new combinations of groups, and of the present application of the names, I trust that entomologists will feel no difficulty in the mental connexion of the word Neuroptera with the dragon-flies, heretofore and still the type of the class, nor of the word Stegoptera, or "roof-winged," with the ant-lions and lace-wings, for which Dumeril originally intended it.

I now proceed to a more detailed account of the contents of the new classes : the divisions are so perfectly natural, that naturalists are already agreed on them, with a single exception ; and they may be briefly expressed by the following formula.

Divisions of NEUROPTERA.

- Larva and pupa aquatic, carnivorous : —
 Wings when at rest erect, meeting vertically over the back : —
 dissimilar, fore-wings large, hind wings small : tarsi 5-jointed EPHEMERINA, *Newm.*
 alike : tarsi 3-jointed AGRIONINA, *Newm.*
 Wings when at rest porrected horizontally:
 tarsi 3-jointed LIBELLULINA, *Newm.*
 Wings lying flat on the back : tarsi 3-jointed PERLINA, *Newm.*
 Larva and pupa terrestrial or arboreal, omnivorous or phytophagous : —
 Wings lying flat on the back, alike, reticulated : tarsi 4-jointed TERMETINA, *Newm.*
 Wings deflected over the abdomen, dissimilar ; fore wings large, hind wings small : tarsi 3-jointed PSOCINA, *Newm.*
 Wings lying flat on the back, alike, fringed, without veins : tarsi 2-jointed... THIRIPSINA, *Newm.*

Divisions of STEGOPTERA.

(*Tarsi uniformly 5-jointed*).

- Larva subcortical or arboreal, supposed to be phytophagous : —
 Mouth prolonged into a beak PANORPINA, *Newm.*
 Mouth of ordinary form : —
 Fore-legs simple RAPIDIINA, *Newm.*
 Fore-legs raptorial MANTISPINA, *Newm.*
 Larva aquatic, supposed to be phytophagous : —
 living in a case PHRYGANEINA, *Newm.*
 naked, natatory CORYDALINA, *MacL.*
 Larva terrestrial, insectivorous : —
 digging pitfalls for its prey..... MYRMELEONINA, *M'L.*
 living on leaves and feeding on Aphides HEMEROBIINA, *MacL.*

Characters of EPHEMERINA.

Larva aquatic, breathes by means of external gills, which also serve as organs of natatory locomotion : it has long filiform multiarticulate antennæ, corneous but small and feeble mandibles, long and strong legs, and three long filiform multiarticulate caudal setæ : it frequents the bottom of ponds, and especially of running streams, is fond of secreting itself under stones, and appears to feed on the decomposing organic matter which mingles so largely in the sediment of all waters.

Pupa similar to the larva in its forms, habits, and food ; the rudiments of the wings are however very perceptible at the posterior angles of the wing-bearing segments : it attains its perfect state by a double ecdysis ; after the first, the insect retains the soft silky pellicle which invests a great number of insects, and which, in all other cases, is shed with the pupa-case ; but, although remaining in this pellicle, it assumes its final form, and (*mira-bile dictu* !) acquires the power of flight : after a feeble flight the insect settles, and in the course of a few hours divests itself of the pellicle, and has then accomplished all its transformations.

Imago with very short 3-jointed antennæ, the terminal joint longest, and a mere seta : 3 ocelli : the mouth is so soft and fleshy as to become amorphous after death, and its component parts totally obliterated : Latreille and Savigny, our greatest cibarian entomologists, examined the mouth of these insects, and the former left descriptions, the latter figures, of its parts ; but these do not correspond, and I confess to my own entire inability to verify their observations : the life of these insects being proverbially short, and spent almost entirely either at rest or on the wing, we may conclude that the imago does not feed, and hence, probably, the apparently imperfect development of the cibarian organs : the prothorax is atrophied : the wings are much reticulated with veins, and very unequal in size, the fore wings being ample, the hind small, and sometimes totally wanting ; they are held perfectly erect, meeting over the back when the insect is at rest, like those of a butterfly : the flight is in the evening, and in company, like that of some guats, rising and falling, and is remarkable for its extreme elegance : the wings appear to be moved only in rising, the insect floating downwards by its own weight, with motionless and semi-expanded wings : the legs are simple and slender, the fore-legs longer and porrected in the

males: the abdomen terminates in long caudal multiarticulate setæ.

The following formula, founded on the researches of Dr. Leach, exhibits the characters by which these insects may be again readily subdivided.

Wings 4: —

Caudal setæ 2 BAETIDÆ, *Newman*.

Caudal setæ 3 EPHEMERIDÆ, *Newman*.

Wings 2: —

Caudal setæ 3 CENIDÆ, *Newman*.

Caudal setæ 2 CLOEONIDÆ, *Newman*.

Characters of AGRIONINA.

Larva aquatic, breathing by means of an internal abdominal apparatus, which, like the internal gills of fishes, or the external gills of the Ephemerina, appears to possess the power of abstracting oxygen from water, which is subsequently expelled through the anal aperture with a jerk which propels the insect forward, and seems to constitute its only natatory movement, although it crawls on mud, stones, and the stems of aquatic plants: it has moderately long, filiform, 7-jointed antennæ, corneous mandibles, and a remarkable jointed and porrectile labium, with which it seizes the small aquatic animals which constitute its food: its body is long and linear, with six legs of moderate length, and three long flattened caudal appendages: it is carnivorous, and excessively voracious.

Pupa in figure, habits, and food *resembles the larva*, but possesses rudimentary wings.

Imago with short slender antennæ, usually but not constantly 7-jointed: *transverse hammer-shaped exerted head: round widely separated lateral eyes: complete manducatory mouth: atrophied prothorax: cylindrical abdomen: four wings minutely reticulated and all alike, their shortest diameter near the base, their longest diameter at three fourths of the distance from the base to the apex, the increase being uniform throughout, they are held above the body of the insect when at rest, meeting each other back to back: legs simple and of uniform length, tarsi 3-jointed: they walk slowly and awkwardly, fly feebly and heavily in the sunshine, and continue but a short time on the wing: feed entirely on living insects: the tarsi are 3-jointed.*

The Agrionina may be divided according to the subjoined formula.

Those in which the continuity of the costal margin of the wing is interrupted or broken near the base, and the costal cells between this break and the base have scarcely any transverse veins, AGRIONIDÆ, *Newm.*
non *Leach.*

Those in which the continuity of the costal margin of the wing is interrupted or broken at more than a third of the distance from the base towards the tip, and the costal cells between this break and the base have very numerous and regular transverse veins, CALEPTERYOIDÆ, *Newm.*

Characters of LIBELLULINA.

Larva aquatic, breathing by means of an internal abdominal apparatus, which appears to possess the power of abstracting oxygen from water, which is subsequently expelled through the anal aperture with a jerk; it has rather short filiform antennæ, corneous mandibles, and a jointed porrected labium; its body is rather robust, and gradually attenuated towards the caudal extremity, which is furnished with three flattened appendages: it is carnivorous and excessively voracious.

Pupa *in figure very unlike the larva, short, obese, and somewhat toad-like*, its wing-cases large and conspicuous, the abdomen turned up at the extremity, and furnished with short conical appendages: habits entirely aquatic, carnivorous, voracious.

Imago with very short and slender antennæ, transverse, *subglobose*, exserted head *generally occupied exclusively with the enormous approximate eyes*, and powerful, fully developed mouth, 3 ocelli, atrophied prothorax, elongate variously formed abdomen; 4 reticulated wings, nearly alike but not quite so, the *shortest diameter of the fore, and the longest diameter of the hind wings is near the base; all of them are porrected separately and horizontally when at rest*, and never meet back to back above the abdomen; their *flight is powerful, rapid, and enduring*, their lives are spent almost entirely on the wing, hawking for insects, especially over pools and in damp woods; they are excessively voracious and predatory, seizing their prey on the wing, and settling for the purpose of devouring it: their tarsi are 3-jointed.

The following formula for dividing the Libellulina into groups, is proposed as provisional only ; but being founded on the acute observations of Leach, Van der Linden, Charpentier, Selys de Longchamps, Rambur and Brullé, it may be considered as expressing the present state of our knowledge of these neglected but remarkably conspicuous and beautiful insects : they inhabit every part of the globe, and the number of species appears to be enormously large.

Labipalpi biarticulate : ocelli in a triangle : —

Anal angle of hind wings rounded in

both sexes LIBELLULIDÆ, *Newm.*
non *Leach.*

Anal angle of hind wings acute in ♂,

rounded in ♀ CORDULIADÆ, *Newm.*

Labipalpi triarticulate : ocelli in a line : —

Eyes contiguous ÆSCHNIDÆ, *Newm.*

Eyes separate GOMPHIDÆ, *Newm.*

Obs. — It will be observed that this and the preceding group are new, having hitherto been united : but they seem to me distinctly separated, neither am I aware of any species or so-called genera occupying debateable ground between them.

Characters of PERLINA.

Larva aquatic, breathing by external tufted branchiæ attached to the leg-bearing segments, with long filiform multiarticulate antennæ, strong corneous mordent mandibles, depressed body, broad flattened head, and two long multiarticulate caudal setæ : frequents the bottom of clear running streams, secreting itself under stones, and feeding indiscriminately on all minute aquatic animals.

Pupa closely resembling the larva in form, habits and food, the only conspicuous difference that obtains is the prolongation of the posterior angles of the wing-bearing segments into processes, evidently containing the future wings of the imago.

Imago with long filiform multiarticulate antennæ, corneous masticatory mandibles, broad flat head, distant hemispherical eyes, equally developed leg-bearing segments, 4 membranous recumbent but not deflected wings, nearly alike, the hind wings largest and having the greatest diameter at the base, where they are

longitudinally folded: flight in the evening, laborious, almost invariably descending; feeds on insects.

Obs.—Almost every entomologist of eminence, and amongst them Geoffroy, Reaumur, Fabricius, Olivier, Latreille and MacLeay, have regarded this group as possessing the case-bearing larva and quiescent cocooned pupa of the Stegoptera; but my conclusions are drawn from long and pains-taking observations on the insects themselves, and are confirmed by the subsequent researches of the accurate Picet: I cannot therefore doubt of their correctness.

The following formula expresses what we know of the subdivision of this group.

Imago breathing by external branchiæ as	
well as tracheæ	PTERONARCIDÆ, <i>Newm.</i>
Imago breathing by tracheæ only:—	
and has 2 caudal setæ	PERLIDÆ, <i>Newm.</i> , non <i>Leach.</i>
and has no caudal setæ.....	NEMOURIDÆ, <i>Newm.</i>

Characters of TERMITINA.

Larva and pupa terrestrial, active, hexapod, furnished with powerful mandibles: social, constructive, voracious, omnivorous.

Imago with moderately long moniliform antennæ, depressed head received in the prothorax, hemispherical small distant lateral eyes, strong corneous mandibles, fully developed and transverse prothorax, 4 long membranous wings of equal size and form, which when at rest are decumbent but not deflected, the hind pair not folded, abdomen with two minute caudal papillæ: flies slowly and laboriously, and rids itself of its wings before founding a new colony; some authors assert that the wings are articulated to the thoracic segments, and fall off spontaneously at the articulation; Mr. Davis asserts that he saw the insect *bite off* its own wings: tarsi 3- or 4-jointed.

Obs. 1. — These are the white ants, universally known by their extraordinary constructive instincts.

Obs. 2. *Relating to the present confusion of the states of larva and pupa.* — In social necromorphous insects, the Formicina for instance, we have commonly four kinds of imagines or adults, these are perfect males and females, and imperfect males and females; in these latter, the progress of development appears to have been arrested at a given point by a certain law of Nature, which seeks, in these instances, the

well-being and preservation of the species, through the labours of the great mass of individuals, and consequently requires labourers devoted solely to the task: the two kinds of apterous individuals which perform the labours of an ants' nest, are clearly neither more nor less than, the smaller, imperfect males, the larger, imperfect females. Among social isomorphous insects, in which the general figure and character is preserved from the egg to the imago, and is little more than a gradually progressive development in size, accompanied by a slight modification in form after every ecdysis, we have strong reasons for believing that these four kinds of individuals differ even from the egg, thus giving us four kinds of larvæ, four kinds of pupæ, and four of imagines. Such being the *rationale* of the composition of a colony of white ants, such being a summary of what, by analogy, we are to look for in inspecting its individuals, there is no just cause for surprise, if when, by analogy, we may calculate on finding twelve kinds of individuals, we do actually discover six or eight; neither is it at all astonishing, that with these six or eight kinds of individuals we should be unable to pronounce immediately and with certainty on the states of each; that is, to say that such an individual is the larva of a perfect female, and such another the pupa of an imperfect male. Latreille tells us that he found individuals having what he supposed the rudiments of wings attached to the wing-bearing segments, and that he therefore thought himself at liberty to conclude that these were pupæ, and subsequent authors have regarded this matter as settled; but we cannot consider this a sufficient conclusion: in all probability the great majority, as in the Hymenopterous ants, never attain wings at all, and the pupæ of such apterous imagines consequently possess no rudiments of wings; hence it follows that Latreille had only discovered one of the forms of pupa, without settling which. The individuals called by the illustrious author "neuters," and which Smeathman graphically described as "soldiers," and Fabricius as "pupæ," and which appear to be as scarcely one in a hundred to the smaller individuals which perform the labours of the community, are probably imagines, both male and female, arrested like the working apterous Hymenopterous ants, while still imperfectly developed. We are in want of more entomological observations, and also more philosophical deductions, before these matters can be finally settled.

The Termitina appear to be capable of division into two minor groups, by the length of their wings and the joints of their tarsi, according to the following formula.

simple: tarsi 4-jointed TERMITIDÆ, *Newm.*
non *Leach.*

lated : tarsi 3-jointed EMBIADÆ, *Newm.*

Pupa resembling the larva in figure, habits, and food, but with rudimentary wings at the posterior angles of the wing-bearing segments.

The whole of this group is at present comprised
in the family PSOCIDÆ, *Leach.*

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Pupa resembling the larva in figure, habits, and food, it differs in its slower movements, in the less equal development of the leg-bearing segments, in having its antennæ bent back on the sides of its head, and in having its wings distinctly visible, attached in a rudimentary form to their respective segments.

Imago of the same general figure, habits, and food as the preceding

states : the head is oblong, the eyes oval, lateral, distant, and placed very forward in the head ; the ocelli are three, and placed between the eyes ; the antennæ are moderately long, moniliform, and have six or seven very distinct joints : the head, which is lengthened in front, is bent back towards the prosternum, and is produced into somewhat of an obtuse rostrum ; all the parts of the mouth are present, the mandibles being corneous, lengthened, acute, very slender, incurved at the apex, broad and somewhat swollen at the base ; the palpi exhibit no peculiarities, and there is not the least trace of the part I have called "galea," and which is so conspicuous, various, and important in the Coleoptera and Orthoptera : the prothorax is largely developed, receiving the head ; the meso- and metathorax are soldered together : the wings are four, membranous, almost veinless, exactly alike, and fringed with long silky hairs ; the legs are moderately long and simple, the profemora sometimes incrassated, the tarsi 2-jointed, rather swollen and without claws. These insects are minute, and infest in countless thousands the blossoms of Dahlias, Fuchsias, and other cultivated plants, often entirely destroying their beauty : one species is particularly injurious to wheat in some seasons, but its ravages fortunately are not common. They are so abundant throughout the summer, that it is almost impossible to shake a flower of any kind over a sheet of white paper, without procuring them : they rarely fly, and their flight is laborious and of brief duration.

Obs. 1. — Mr. Haliday, whose invaluable and highly philosophical papers on Entomology, published in the 'Entomological Magazine,' stamp him as one of the first, if not the very first of living entomologists, regards the Linnean genus Thrips as a group of insects equivalent in its distinctness to Coleoptera, Lepidoptera, Diptera, &c., and assigns it the name of Thysanoptera : yet Mr. Walker, although no one is so thoroughly acquainted with Mr. Haliday's views, has associated these insects with the Homopterous Hemiptera. To differ from two authors so justly celebrated, would almost be tantamount to declaring myself in error, were it not that their views are so dissimilar ; this circumstance may serve as an apology for differing from either, and therefore equally so for differing from both. It may at the same time be allowable to state, that although the observations of Haliday threw the first light, and a flood of light it was, on the structure and classification of these minute creatures, yet his materials were so limited, and

so very much restricted geographically, that we are compelled to consider the study of the Thripsina as still in its infancy.

The following formula, copied from the fourth part of Mr. Walker's 'List of the Homopterous Insects in the British Museum,' exhibits the views entertained by Mr. Haliday of a systematic arrangement of these insects.

Terebra fœminis

nulla :	Fam. 1. TUBULIFERA.
ocelli	
tres, anticus distans.....	Gen. 1. IDOLOTHRIPS.
tres, æquidistantes (aut obsoleti)	„ 2. PHLÆOTHRIPS.
quadrivalvis acuta :	Fam. 2. TEREBRANTIA.
incurva	Tr. 1. STENOPTERA.
antennæ apice	
capillacæ	Gen. 3. HELIOTHRIPS.
stylatæ : abdomen	
tomentosum	„ 4. SERICOTHRIPS.
subnudum.....	„ 5. THRIPS.
antennæ apicula	
connata	Sub-gen. 1. APTINOTHRIPS.
discreta; prothorax apice	
valde angustatus	„ 3. CHIOTHRIPS.
parum attenuatus :	
abdomen dorso	
efoveolatum	„ 2. LIMOTHRIPS.
seriatim foveolatum	
apicula pro ratione	
articuli 6ti	
brevis	„ 4. THRIPS.
elongata	„ 5. BELOTHRIPS.
recurva :	Tr. 2. COLEOPTRATA.
antennæ	
articulis 9 discretis	Gen. 6. MELANTHRIPS.
articulis 5 citra apiculam	„ 7. ÆOLOTHRIPS.
alæ completæ	Sub-gen. 1. COLEOTHRIPS.
alarum rudimenta tantum	„ 2. ÆLEOTHRIPS.

Obs. 2.—I beg to offer the following reasons for placing the Thripsina in the class Neuroptera :—

First.—Those naturalists who either extend their systems to the whole of animated nature, or confine them to the typical group,

the vertebrated animals, invariably seek to include all animals, however aberrant, in one or other of the primary divisions: we occasionally see much ingenuity exhibited in settling the question to which division an animal belongs; for instance, Ornithorhynchus, Lepidosiren, Pterodactylus, Deinotherium, Ichthyosaurus, have all afforded scope for argumentative writing in this way: entomologists would unhesitatingly have ranked these as primary groups of vertebrated animals, equivalent to mammals, birds, reptiles and fishes; but it seems to me that the general zoologists are right in considering to which established group such abnormal forms can be referred, rather than in creating new groups purposely to receive them. Applying the same reasoning to insects, I think we ought to inquire to what established entomological group an aberrant species or genus belongs, rather than to create a new group purposely for its reception. Assuming then that Thrips is referrible to an established group, we have next to consider to what group it is referrible.

Secondly.—The metamorphosis of Thrips is totally different from that of Lepidoptera, Diptera, Hymenoptera, Coleoptera, and Stegoptera; it agrees tolerably well with that of Orthoptera and Hemiptera, and is positively identical with what we know of that of the Perlina, Psocina, and Termetina among the Neuroptera.

Thirdly.—The structure of the mouth absolutely forbids its association with the Hemiptera or Orthoptera, but differs no more from that of Neuroptera, than those of the divisions of Neuroptera do among themselves: for instance, than the Perlina do from the Agrionina, the Psocina from the Perlina, the Ephemerina from all the rest: the mandibles, considered so anomalous, are almost exactly similar to those of *Corydalis cornuta* in the Stegoptera, which no one has ever attempted to separate from its congeners.

Fourthly.—The perfect similarity of the fore and hind wings in Thrips is characteristic of Neuroptera, and especially of the Agrionina and Termitina, and is totally at variance with what obtains in all other classes.

On these grounds I have no hesitation in expressing my decided conviction that the Thripsina form an integral part and a primary section of the Neuroptera.

Characters of PANORPINA.

Larva unknown.

Pupa necromorphous : a single individual (of *Panorpa*) has been figured by Stein in Weigmann's 'Archives.'

Imago with long, setaceous, many-jointed antennæ; lateral, distant, hemispherical eyes; and the head produced into a long, deflexed beak, bearing the mouth at the extremity, as in the *Curculionina*.

This group may be divided in accordance with the following formula.

Ocelli 3, placed in a triangle between the
eyes, PANORPIDÆ, *Newm.*

Ocelli 0 : —

Wings porrected when at rest, greatly
dissimilar, fore-wings ample, much
reticulated, hind-wings lengthened to
four times the length of the body,
and perfectly linear NEMOPTERIDÆ, *Newm.*

Wings when at rest deflexed, ample, re-
ticulated, similar MEROPESIDÆ, *Newm.*

Wings rudimentary only BOREIDÆ, *Steph.*

Obs. 1.—The Panorpidæ are divided into two genera, *Panorpa* and *Bittacus*; they are closely allied, but the latter is distinguishable at once by its greatly lengthened legs and wings.

Obs. 2.—The family Meropesidæ, founded on the genus *Merope*, is nearly allied to the Boreidæ, with which it would readily associate but for its ample and normal wings. It is a native of North America, and has the Stegopterous character of roof-like wings, which in the Panorpidæ and Nemopteridæ is not perceptible.

Characters of RAPHIDIINA.

Larva elongate, slow, much resembling in figure that of many Coleoptera, but having the meso- and metathorax more restricted : the mandibles are corneous and acutely toothed; the antennæ are very short and 3-jointed, and, together with the strong curved legs, exhibit many analogies with those of certain Coleoptera : it burrows in the dead bark of trees, never leaving the gallery which it excavates; hence it may be inferred that it feeds on the dead bark, but entomologists have concluded, from the structure of the mandibles, that it is carnivorous : if so, it is the only instance on record of a carnivorous larva forming galleries.

Pupa necromorphous: the antennæ reflected and immovable, but the legs distinct from the body, and said to be used in walking; having only seen it in spirits, I cannot confirm this: wings rudimental, but very apparent, folded over the hind legs, an arrangement which seems altogether opposed to the alleged power of walking: it changes in the galleries formed by the larvæ, and is not enveloped in a cocoon.

Imago with an ovate head narrowed behind, and long narrow prothorax, articulated loosely so as to admit of an easy snake-like motion of the head and neck, whence the specific name of *ophiopsis*: eyes hemispherical, lateral, very distant: antennæ filiform, many-jointed; mandibles strong, corneous, curved, and sharply toothed: meso- and metathorax short, transverse, much broader than the prothorax: abdomen soft, terminating, in the females, in a falciform ovipositor: legs simple, almost precisely resembling those of pseudo-tetramerous Coleoptera, the basal joint being long, the second very much shorter, the third deeply cleft and produced into two large lobes, the fourth very short and placed in the cleft, and the fifth moderately long and of ordinary form: not uncommon in dry woods, and supposed to feed on insects.

I am only acquainted with one genus, Raphidia, forming the family *RAPHIDIADÆ*, Newm.,
RAPHIDIIDÆ, Leach.

Characters of MANTISPINA.

Larva and pupa unknown.

Imago with short many-jointed antennæ, slightly thickened towards the tip; corneous acute curved mandibles; broad transverse head; distant hemispherical eyes, occupying nearly the whole of each lateral surface; long, narrowed, and often transversely furrowed prothorax; elongate raptorial fore-legs; broad transverse mesothorax; narrow transverse metathorax; large and conspicuous propodeon; simple middle and hind legs; soft, moderately long, slightly incrassated abdomen, unprovided with any processes at its extremity: wings alike, roof-like, transparent, glittering, beautifully reticulated, no portion of them folded.

These insects may at present be included in the single family,
MANTISPIDÆ, Newm.

Obs. — It remains a matter for future consideration, whether the Raphidiina and Mantispina should be united: to me there appear many points of resemblance between them, but others of decided difference; indeed, the more attentively the anatomy of Raphidia is studied, the more closely will it be found to approach the Coleoptera; while Mantispa, especially in its raptorial fore-legs, exhibits a like approach to the Mantina among the Orthoptera: this different tendency induces me to continue them separate.

Characters of MYRMELEONTINA.*

Larva short, obese, inactive, with a flat head and oval body; the antennæ are short and setiform; the mandibles long, toothed, and slightly curved, perfectly adapted to seizing their living insect prey; along the sides of the body are fasciculi of stiff bristles, amounting to a regular fringe in one of the families (Ascalaphidæ). These larvæ, under the familiar name of "ant-lions," or some equivalent for that term, have been celebrated in all ages for their instinctive habit of excavating pitfalls, in the shape of an inverted cone, at the bottom of which they lie concealed all but the mandibles, awaiting the arrival of their prey, which having once fallen over the side of the excavation, cannot maintain a footing on the light sand of which its sides are composed, but gradually descends (the sand giving way beneath its feet) to the very bottom, where it is seized by the rapacious larva lying in wait to receive it; its juices are sucked out, and the empty skin is thrown to a considerable distance by the muscular exertion of the ant-lion. The larva of Ascalaphus is not generally supposed to make an excavation, but it lies in wait amid sand or light earth, in the same manner as that of Myrmeleon: some few of the Myrmeleontes are also aberrant in this respect.

Pupa strictly necromorphous, bearing no resemblance to the larva, than which it is remarkably smaller, and the head and tail are bent towards each other, so as nearly to meet; in some of the species it is contained in a spherical cocoon of silk interspersed with grains of sand; in this it changes to the imago, and the head escaping first from the shell of the pupa, gnaws with its

* *Myrmecoleon*, and not *Myrmeleon*, ought certainly to have been the name of the genus; but I cannot agree with Burmeister in thinking we are at liberty to alter it: such a liberty would re-open questions long since supposed to be decided.

newly acquired mandibles a hole through the wall of the cocoon, through which the imago passes, leaving the shell of the pupa still projecting from the aperture: it is a common belief that the pupa gnaws this opening, but this is not the case, the pupa having no command whatever over its cibarian apparatus.

Imago without the slightest resemblance to the larva, and scarcely any to the pupa; its head is transverse, and its antennæ generally incrassated outwardly, although in some *Myrmeleontes* almost filiform; its mandibles are corneous, curved, and mordent; its body long, slender, and cylindrical; and its wings of uniform size and shape, and finely reticulated.

The contents of this group seem to be capable of subdivision in accordance with the following formula.

Antennæ abruptly capitate:—

of nearly the same length as the wings,

Eyes divided *ASCALAPHIDÆ*, *Newm.*

Eyes undivided *HAPLOGLENIIDÆ*, *Newm.*

of nearly the same length as the head, *STILBOPTERICIDÆ*, *Newm.*

Antennæ gradually clavate, short, *MYRMELEONTIDÆ*, *Newm.*

Obs. 1.—The *Ascalaphidæ* are divided by M. Rambur into the genera *Ascalaphus*, *Theleproctophylla*, *Puer*, *Bubo*, *Ulula*, and *Colobopteris*: after a careful examination of the characters employed by this learned entomologist, I feel considerable hesitation in adopting them as indicative of more than specific differences. I may perhaps be pardoned for objecting also to names previously used in a sister science.

Obs. 2.—The *Haplogleniidæ* are divided by the same entomologist into the genera *Byas*, *Haploglenius*, and *Azesia*, the latter comprising but a single species, the *Azesia Napoleo* of Lefebvre, described and figured in Guérin's '*Magasin de Zool.*' Ann. 1842, Ins. p. 92; but this very striking insect, truly the emperor of its tribe, had been previously described by myself, under the name of *Stilbopteryx marginatus* (see Ent. Mag. v. 399, under date of 1838), and the name had for three years been employed in all our collections: I have regarded it as forming a distinct group.

Obs. 3.—The *Myrmeleontidæ* are divided by Rambur into four genera, *Palpates*, *Acanthoclis*, *Myrmeleon*, and *Megistopus*, and the genus *Myrmeleon* is again subdivided into fourteen sections.

*Proposed Division of Neuroptera*Characters of *HEMEROBIIINA*.

Larva long, flattened, with a rather flat head; short setiform antennæ; long, curved, large and distinct leg-bearing segments: it comes from a very peculiar egg, deposited by the parent on the leaves of trees, to which it is attached by a long foot-stalk: it feeds on Aphides, vast numbers of which it consumes, and hence has obtained the name of *Aphis-lion*.

Pupa strictly necromorphous, bearing some resemblance to the larva; the head and tail are bent towards each other, thus forming a sort of semicircle; it is inclosed in a nearly spherical silken cocoon, in which it remains motionless throughout the winter.

Imago bearing no resemblance to the larva, and very little to the pupa: it has a small transverse head, with distant hemispherical eyes, remarkable in the genus *Chrysopa* for their excessive golden brilliancy; moderately long, filiform, multiarticulate antennæ; acute, corneous, mordent mandibles; four ample, similar, beautifully reticulated wings; distinct prothorax; soft cylindrical body; and moderately long simple legs: they fly languidly and heavily; and when irritated or crushed, many of the species emit a most offensive odour.

The *Hemerobiina* may be divided into four principal groups, as expressed in the following formula.

Ocelli 3:—

Wings long in proportion to their
breadth, very much resembling the
ant-lions' *OSMYLIDÆ*, *Newm.*

Ocelli 0:—

Antennæ setaceous, labrum emarginate *CHRYSOPIDÆ*, *Newm.*

Antennæ moniliform, labrum entire..... *HEMEROBIIIDÆ*, *Newm.*,
non *Leach*.

In this division must also be placed a small and very singular insect, the *Hemerobius parvulus* of Vill. Ent. Linn., which is also the *Phryganea alba* of Fab. Ent. Syst., the *Malacomyza lactea* of Wesm. Bull. Acad., and the *Coniopteryx Tineiformis* of Haliday, in Curt. Brit. Ent. The larva is short and obese, very much like that of the ant-lion; it is apparently entomophagous, and when full-fed spins a spherical and perfectly white cocoon, which is generally attached to the bark of a tree: the pupa is perfectly quiescent, and, like the larva, short and obese: the imago has multiarticulate filiform antennæ, large lateral eyes, entire labrum, horny acute mandibles, a bifid lacinia to the maxillæ, long slender 5-jointed maxipalpi, a truncate labium, elon-

gated approximate 3-jointed labipalpi, atrophied prothorax, four nearly equally-sized wings, the lower pair smallest, their nervures following the formula of *Panorpa* rather than of *Hemerobius*, and covered with a white powder: the legs simple, of moderate size, and the tarsi 5-jointed, with the penultimate joint bilobed. There are several specific names in addition to those mentioned above, as *Aphidiformis*, *Psociiformis*, &c., but whether or not they represent species, I am quite unable to say. For this little group I propose the name of

CONIOPTERYCIDÆ, *Newm.*

Obs. 1.—The genus *Psychopsis*, at present consisting of the single species, *Psychopsis mimica*, a most lovely insect from New Holland, which has every appearance of the clear-winged *Pieridæ* among butterflies, must for the present be placed with the *Hemerobiidæ*.

Obs. 2.—Other forms of *Hemerobiina* remain to be characterized: it is possible that *Aleyrodes* may find its affinities with *Coniopteryx* rather than with *Aphis*.

Characters of CORYDALINA.

Larva hexapod, active, aquatic, with short slender antennæ, corneous toothed mordent mandibles, soft fleshy body, and a series of remarkable articulated false legs, a pair of which is attached, as in the larvæ of the *Lepidoptera* and the *Tenthredinina*, to each segment of the abdomen; these are evidently natatory organs, and although all authors seem to agree that they are also respiratory organs, like the external branchiæ of the *Ephemerina*, this must not be taken for granted: the appendages in the two groups are totally different; in the *Corydalina* being slender, cylindrical, quinque-articulate antennæform organs, without any external indication of respiratory functions: although aquatic, this larva is able to live out of water, remaining unchanged for a long time in its earthy cell, without any indication of that shrivelling which so quickly attends the respiratory apparatus of the *Ephemerina*, causing speedy death: that these organs are connected with respiration is quite possible, but the premises from which this inference has been drawn are insufficient: there is a single hairy caudal process.

Pupa strictly necromorphous, perfectly quiescent, but capable of some motion when touched or irritated, it changes in a spherical earthen cell, formed with care by the larva in the banks of streams; the head and tail are bent, probably like those of the two preceding groups, to accommodate the insect to the restricted limits of the cell.

Imago having scarcely any similarity to either larva or pupa, with transverse head, deeply received into the well-developed prothorax; the wings are nearly alike, recumbent, and deflected, numerous veins, but not finely reticulated, the hind-wings are longitudinally folded.

These insects appear further divisible in accordance with the following formula.

Ocelli 3 : —

Body clothed with hair..... ITHONESIDÆ, *Newm.*

Body naked : —

Antennæ simple CORYDALIDÆ, *Newm.*

Antennæ pectinated CHAULIODESIDÆ, *Newm.*

Ocelli 0 SIALIDÆ, *Leach.*

Obs. 1.—The Ithonesidæ appear to be a numerous group, confined to New Holland. Ithone is the only genus described, but there are many species, and these very dissimilar, and likely to be generically subdivided when we become better acquainted with the entomological productions of the wonderful country in which they are found.

Obs. 2.—In this division must also be placed, at least provisionally, the curious Spanish insect, *Dilar Nevadensis* of Rambur, which has much the appearance of a Hemerobius, but the male has pectinated antennæ, and the female a very long exserted ovipositor: the antennæ of the male are rather longer than the body, and have twenty-six articulations, each of which is furnished with a single long branch at its extremity, these gradually increase in length from the base to the tenth articulation, and from this decrease to the tip. The mouth has not been examined, and the economy is entirely unknown. Not being able to associate this insect with any other division of the Corydalina, I propose to institute the division DILARIDÆ, *Newm.*

Characters of PHRYGANIINA.*

Larva aquatic, much resembling in figure that of the Lepidopterous genus *Psyche*; the head is small, without antennæ, and having corneous mordent mandibles; the leg-bearing segments are of equal development, and have a coriaceous skin; the legs are short; the abdominal segments are covered with a soft skin, and are inclosed in a case constructed of extraneous materials, after the manner of the genus *Psyche* and other *sackträger*

* I think the name of the genus should have been *Phryganodes*, i. e., consisting of fragments of twigs, or like a little bundle of dry twigs, and the group would in that case have been *Phryganodeina*: the termination I have given I am aware is unclassical.

among the *Lepidoptera* : in this case they reside at the bottom of running streams ; they feed principally on decaying leaves and other vegetable substances which fall into the water, but also, as proved by Pictet, on other aquatic larvæ : they are supposed to breathe by means of external abdominal filaments, which, in some of the species, are separate and very conspicuous, in others they are grouped in bundles, but their office is rather assumed than proved.

Pupa necromorphous : when arrived at its full growth, the larva spins, by means of an oval spinneret like that of the silk-worm, an open net across both ends of the case, and this allows the pupa, which possesses the same (supposed respiratory) filaments as the larva, to breathe by separating oxygen from the water which passes freely through the case ; the posterior extremity is firmly attached to some stick, stone, or other substance, at the bottom of the stream : in figure the pupa closely resembles the imago, all its limbs being discernible : when the time arrives for its assuming the imago state, the mandibles are first liberated from their investing membrane, and with these it gnaws an opening in the net-work at the anterior extremity of the case, and its specific gravity being less than that of water, it soon emerges altogether from the case, and rising to the surface there floats, until propelled by the casualties of winds or currents to the shore, when, by means of its liberated fore-legs, it crawls up a twig, a blade of grass, a stone, or other convenient object, and there completes its metamorphosis.

Imago with small exserted head ; very long, filiform, multiarticulate antennæ ; distinct, lateral, hemispherical eyes ; three epicranial ocelli ; the palpi long, porrected, and conspicuous ; the other cibarian organs mere rudiments ; the prothorax atrophied ; the wings dissimilar, almost revolute, of nearly equal size, the hind wings folded longitudinally ; the legs long, the tibiæ spurred ; the body and wings covered with hair, and the entire figure and habit resembling the *Tineina* amongst *Lepidoptera* : the flight is generally slow, in the evening, and for a short distance ; the life short ; the food none.

This group is the only one amongst the *Stegoptera* which has been thoroughly worked : the task has been admirably executed by M. Pictet, of Geneva. The following formula, although based on characters of the larva and pupa, is confirmed and supported by those of the imago.

cciv *Proposed Division of Neuroptera into two Classes.*

Larva residing in a movable case, which is
carried on its body as a snail carries
its shell : —

Case opening in a circle : —

Thoracic segments rounded : —

Supposed organs of respiration

single, filamentous *PHRYGANEIDÆ, Newm.*

Supposed organs of respiration in
bundles : —

Hind legs long..... *MYSTACIDIDÆ, Newm.*

Hind legs short *SERICOSTOMIDÆ, Steph.*

Thoracic segments with the front an-
gles pointed

TRICHOSTOMIDÆ, Newm.

Case opening with a slit..... *HYDROPTILIDÆ, Steph.*

Larva residing in a fixed case : —

Pupa in a double envelope..... *RHYACOPHILIDÆ, Steph.*

Pupa inclosed in a single envelope *HYDROPSYCHIDÆ, Steph.*

From this analytical view of the contents of the two proposed classes, it results : —

1. That there is no difficulty in defining the limits of each, and no genera occupy debateable ground between them.

2. That there is no discrepancy in the numerical contents ; that is, that their divisions and subdivisions, as families, genera, and species, nearly correspond.

3. That in the distinctive characters laid down, that of metamorphosis is employed as imperative in all other instances in the science of Entomology, and therefore, that its employment as imperative in the present instance, is no innovation, nor any deviation from an accepted law of the science.

4. That the divisions flow naturally into each other as now arranged, whereas in all arrangements where the fourteen minor groups are treated as parts of a single major group, and arranged in accordance with structure only, there are perpetual violations of Nature : groups are approximated that have only a single character in common, and others dis severed that are all but identical.

Under such circumstances, I cannot entertain a doubt that the classes Neuroptera and Stegoptera will hereafter be received as essential component parts of all systems of Entomology.

EDWARD NEWMAN,

September, 1832.