

of *capsella* Gld., and doubtless have been and will be taken for such. A lot of fine examples, received from the same author, collected in eastern Tennessee and named *capsella* are, to all probability, nothing else but adult specimens, in which the last whorl becomes comparatively more voluminous and commonly more descending. The spire is variable from almost flat to rather elevated, and also the umbilicus shows some differences. Among lots, which to all appearance, were *Zon. capsellus*, there were examples with a single, sometimes barely perceptible, tooth.

9. With all this, I do not feel positive, at present, that *Zon. andrewsi* W. G. B., and *significans* Bld., are only the juvenile forms of *Zon. placentulus* Shuttl. and *capsellus* Gld. But so much is sure, that they must be desperately similar, respectively, and that they need careful revision, also as to anatomy. The words of W. G. Binney that the latter form "a puzzling group," become of an increased meaning now.

10. For faunistics, it may be of interest that there were a few specimens of *Hyal. ferrea* Msc., from eastern North Carolina, among the materials sent by Mrs. Andrews. In my collection there is one from Randolph Co., West Virginia. Also from different places in eastern Ohio it is known.

New Philadelphia, Ohio, May, 1893.

A REVIEW OF VON IHERING'S CLASSIFICATION OF THE UNIONIDÆ
AND MUTELIDÆ.

BY CHAS. T. SIMPSON.

Since the theory of evolution has been generally accepted, a complete revolution has taken place in the methods of study and classification among biologists. All artificial systems, or those based upon a single character, have either been relegated to the past or are hopelessly doomed. Students who are progressive and keep abreast of the times, realize that in the study of organic life it is necessary to seize on to every fact which can possibly aid them in classifying: embryology, anatomy, the study of its development in the past as taught by palaeontology, geographical distribution and habits.

Dr. H. von Ihering, of Rio Grande do Sul, Brazil, has recently

published in Archiv für Naturgeschichte,¹ a lengthy article on the *Najidae* of San Paulo, Brazil, and a proposed system of classification in which some startling discoveries are brought to light, and which ranks as one of the ablest papers ever written on the subject. This classification, while working a complete revolution in our preconceived ideas of the relationships of the different members of this group, is so clear and philosophical, it so thoroughly takes cognizance of all the known facts, that it is certainly worthy of the most thoughtful consideration. In a brief review like this I can only allude to the more prominent points, and those who are interested should read the paper itself.

H. and A. Adams, in the Genera of Recent Mollusca, divide the Naiades into two families, *Unionidae* and *Mutelidae*,² separated by certain minor characters of the shells and animals. Ihering uses the same family names in a somewhat different sense from the Messrs Adams, and unites the whole into a larger group or super-family, which he calls the *Najidae*. He finds in all the genera which he places in the *Unionidae*, the larval state is a *glochidium*, that is, a stage or condition in which the animal is completely enclosed in a porous bivalve shell.

On the other hand, the species which he places in *Mutelidae*, pass through a state after hatching which he calls a *lasidium*, in which the animal is divided into three parts, of which only the middle bears the small, single shell. He finds, on examination, that those South American forms that have hitherto been placed with *Anodon*, pass through the lasidium stage, hence they must be separated from that genus whose larval state is a glochidium, and he retains for this group the name suggested by Gray—*Glabaris*. He believes that *Aplodon*, having a few South American species, hitherto placed in *Monocondylæa*, and the so-called African Anodons belong to the same family, and that the latter should be placed in *Glabaris*.

D'Orbigny established the genus *Monocondylæa* for certain species of South American *Naiadae* whose shells possess a single cardinal, and no lateral teeth. Several of these will fall into other natural groups. Ihering does not mention the Asiatic species which Lea

¹ Najaden von S. Paulo und die geographische Verbreitung der Süßwasser Faunen von Südamerika, von H. von Ihering. Jahrg 59, 1 Bd., 1 Heft.

² Fischer, Manuel de Conchyliologie, p. 997, divides *Unionidae* into two sub-families; *Unioninae* including *Unio*, *Monocondylæa*, *Pseudodon*, *Anodonta*, *Solenia* and *Mycetopus*; 2d *Mutelinae*, with *Mutela*, *Hyria*, *Castalia* and *Leila*.

and others have placed close relationship to the merely depauperate *Unionidae* that genus found with

The *Unionidae* of Europe, and especially of the whole North America, are not only able to live in fresh water, but also in brackish water, and are not only able to live in the same places as the *Unionidae* of the whole North America, but also in the same places as the *Unionidae* of the whole North America. I may remark in passing that the *Unionidae* of New Zealand, and many others, are not only able to live in the same places as the *Unionidae* of the whole North America, but also in the same places as the *Unionidae* of the whole North America. The *Unionidae* of the whole North America, and especially in the present case, are not only able to live in the same places as the *Unionidae* of the whole North America, but also in the same places as the *Unionidae* of the whole North America. Ihering can not only find in all the genera which he places in the *Unionidae*, the larval state is a *glochidium*, that is, a stage or condition in which the animal is completely enclosed in a porous bivalve shell.

I have carefully examined the *Unionidae* of the whole North America, and on the whole, I believe that the *Unionidae* of the whole North America, and especially in the present case, are not only able to live in the same places as the *Unionidae* of the whole North America, but also in the same places as the *Unionidae* of the whole North America. He believes that we should not only find in all the genera which he places in the *Unionidae*, the larval state is a *glochidium*, that is, a stage or condition in which the animal is completely enclosed in a porous bivalve shell. Notwithstanding the opinion of Mr. Wm. A. M. Lea, who has also given this name to the beak sculpture of several species, my own experience from all over the world, and the study of the *Unionidae* of the whole North America, and especially in the present case, are not only able to live in the same places as the *Unionidae* of the whole North America, but also in the same places as the *Unionidae* of the whole North America.

It is only in Europe that the *Unionidae* have been observed during this stage, and they assist in their distribution

³ N. Z. J. of Science, No. 6

and others have placed in this genus, but I believe they have no close relationship to these South American forms, and that they are merely depauperate Unios, which have a close affinity to species of that genus found with them.

The *Unionida* of Europe, North and Central America, and probably of the whole Northern Hemisphere, develop eggs in the outer gills alone as far as is known, with the exception of *Unio multiplicatus* and one or two others, which contain embryos in all four leaves of the branchiae. Ihering states that in all the *Najidae* hitherto examined from South America, the eggs are borne in the inner gills. I may remark in passing that the shells of the Australian, New Zealand, and many South African Unios bear an astonishing resemblance to those of South America in form, texture, smooth epidermis and concentric, sometimes slightly granulated sculpture, and especially in the peculiarly compressed, parallel cardinal teeth, and Suter states¹ that the embryos of *N. menziesi* are borne in the inner gills. Ihering calls attention to the fact that all South American *Unionida* have a radial beak sculpture, and suggests that probably the same character may be found in the New Zealand species.

I have carefully examined extensive series of *Unio menziesi* and *Intolentus*, and on the latter find that the umbos are radiately ribbed where the shells are not too badly eroded, and there are traces of such ridges on the former and on some Australian species. He believes that we shall find the beak sculpture one of the best characters for determining the minor divisions of the *Unionida*. Notwithstanding the opinion of this eminent conchologist, and the fact that Mr. Wm. A. Marshall, of the New York State Museum, who has also given this subject some very careful study, believes that the beak sculpture is quite constant and may be used in determining species, my own experience in handling great quantities of material from all over the world leads me to consider this a somewhat variable character, and although it will no doubt prove very useful in studying species and the smaller groups, yet I am sure it cannot by any means be always relied on.

It is only in Europe that the post-embryonic larvæ of the *Unionida* have been observed actually attached to fishes, though the North American species are known to possess hooks and bristles during this stage, and they no doubt make use of the same means to assist in their distribution, as do their Old World relations.

¹ N. Z. Jl. of Science, No. 6, Vol. I (new issue), p. 250.

Ihering fails to find them on any of the South American *Unionidæ* he has examined, but he has probably overlooked the statement of Lea¹ that the glochidium of *Unio firmus* of Brazil is provided with both of these appendages.

Castalia was placed in the *Mutelidæ* by the Messrs Adams, but Ihering shows that it is very closely and curiously related to *Unio*. In the latter the short branchial siphon is open; in the former it is closed; in *Unio* the lateral teeth are either smooth or obliquely striated;² in *Castalia* they are vertically ridged. He has applied the name *Castalina* to a few species which stand between the two genera, and has given it generic rank. But he shows that there is a complete intergradation and connection from one end of the chain to the other. In certain *Castalias* there is a typical animal, in others it is that of *Unio*, and in *Castalina* there is an almost complete blending and crossing of characters. I have noticed on examining large series of these shells that in some *Castalias* the peculiar tooth sculpture is nearly wanting.

Von Ihering finds that *Unio multistriatus* of Brazil is very closely related to *N. senegalensis* of Africa, and to certain Indian forms. He has, in his collection, a specimen of *Unio radula* of India that is identical with *N. coriaceus* from Rio Janeiro, and believes this fact to be a proof of the long duration of the species of this family and probably evidence in favor of the existence of the lost Atlantis.

His arrangement of the families and genera stands as follows:

<i>Mutelidæ</i> v. Ih. (nec Adams).	<i>Unionidæ</i> v. Ih. (nec Ad.).
<i>Leila</i> Gray.	<i>Hyria</i> Lam.
<i>Glabaris</i> (Gray) v. Ihering.	<i>Castalia</i> Lam.
<i>Aplodon</i> Spix.	<i>Castalina</i> v. Ih.
<i>Plagiodon</i> Lea.	<i>Unio</i> Retz.
<i>Fossula</i> Lea.	<i>Margaritana</i> Schum.
<i>Mycetopus</i> Orb.	<i>Cristaria</i> Gld.
<i>Solenaia</i> Con.	<i>Anodonta</i> Lam.
<i>Mutela</i> Scop.	
<i>Iridina</i> Lam.	
<i>Pleiodon</i> Con.	
<i>Spatha</i> Lea.	

¹ Observations on the Genus *Unio*.

² In *Unio tortuosus* Lea, a remarkable inequivalve species from China, the laterals have perpendicular striae, and Lea remarks that if this is found in all the individuals of the species, it would have to be placed in *Castalia*. It has much the appearance of *Unio ellipsis* Lea.

This class have to be the anatomy adopted is that can recognize artificial, but adopted by groups from ever, and by the facts of ignored.

Some day strawberry them. Of the object of the three specimens. This slug, we been noticed has been introduced to import foreign slugs. and, in many on arrival. arrived plant or we might some of our where the plant in twenty-four worms and 24

The small, spread to many specimens from Pacific coast Islands, Trist. it will inhabit

