tion this was found to be true, and it was discovered that these young mussels—for such they undoubtedly are—are subsequently liberated by the disintegration of the cord after *having passed through the metamorphosis in the entire absence of a parasitic period.* We, therefore, have concluded that the emergence from the cords in the glochidial stage is premature—due possibly to some change which has taken place in the gelatinous substance surrounding them as a result of free contact with the water or to release from the pressure to which they are subjected while in the marsupium. It is perfectly evident that these glochidia neither become attached to fish nor undergo any further development; they have simply come out too soon and are lost.

The young mussels, on the other hand, which have developed inside the cords, when liberated by the disintegration of the latter or removed directly by teasing, are found to have reached as advanced a stage of development as is attained by any unionid at the time it leaves the fish. They closely resemble the young of *Anodonta* at the close of the parasitic period, and upon examination have been found to possess the following structures: the anterior and posterior adductor muscles; the ciliated foot; two gill buds on each side; a completely differentiated digestive tract, including mouth, œsophagus, stomach, intestine and anus; liver; the cerebral, pedal and visceral ganglia; otocysts; the rudiments of the kidneys, heart and pericardium; and also a slight growth of the permanent shell around the margin of the shell of the glochidium. The larval muscle has completely disappeared, although some of the mantle-cells of the glochidium, as well as the hooks of the shell, are still present. They crawl slowly on the bottom of the dish by the characteristic jerking movements of the foot, after the manner of the young of other species at a corresponding stage, although the valves of the shell gape more widely apart and the foot is shorter and less extensible. We have not succeeded as yet in keeping them alive for more than ten days, but it is difficult in the case of any species to maintain young mussels of this age under laboratory conditions.

Since these young mussels do not respond to the stimuli which cause glochidia to close the shell and all attempts to bring about their attachment to fish have failed, and, furthermore, since their behavior in creeping on the bottom is characteristic of post-parasitic life, it would seem clear that no subsequent parasitism is possible. The conclusion is, therefore, inevitable that we have here to do with a species which has no parasitism in its life-history, although the presence of hooks and other typical glochidial structures would indicate that it has originated from ancestors which possessed the parasitic stage like other fresh-water mussels. The cord is undoubtedly to be interpreted as a nutritive adaptation which arises in the marsupium during the early stages of gravidity, since the young embryos are at first contained in an unformed viscid matrix and the cords are a later product.

The whole history of this exceptional species warrants a more detailed study, and Miss Young is now engaged in such an investigation. When her work is completed, we hope that it may include the entire course of development, the method of formation of the cords, and the rearing of the young mussels during a much longer period than has thus far been possible.

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March 25, 1911

THE SCALES OF THE ALBULID FISHES

Albula has long been regarded with unusual interest by ichthyologists, being an isolated type standing near the base of the Teleostean series. It is exceptional among all teleosteans, Boulenger remarks, in having two transverse series of valves to the bulbus arteriosus instead of one; an approach to the condition of the "Ganoids," in which there are three. Gill admits the "Ganoids" into the teleostean series, and according to his arrangement *Amia* falls in the order Cycloganoidei, just before or below the Malacopterygii, of which *Albula* is a primitive member. In Smithsonian Misc. Coll., Vol. 56, No. 3, p. 2, I have

described the scales of *Albula,* showing that they have much in common with those of *Amia,* and are very different from those of *Elops.* The Albulidæ are evidently much nearer to the Cycloganoidei than are the Elopidæ, and if these two families stand side by side in the system, it must be understood that they are nevertheless quite far apart in fact. The striking feature of the scales in which *Albula* resembles *Amia* is the entirely longitudinal (instead of transverse) arrangement of the basal circuli, which in fact should be called *fibrillæ.* In *Amia* the nucleus is subapical, and the broad nuclear area is rugulose or covered with fine labyrinthiform markings. All this is seen in the living *Amia calva,* but even more beautifully in the Miocene *Amia scutata* Cope, scales of which I obtained at Florissant last month. Cope states that the scales of *A. scutata* are larger than those of *A. calva,* but I find them to be practically of the same size, with very strong longitudinal fibrillæ, fraying out basally, and a most beautiful and intricate labyrinthiform sculpture in the broad nuclear area. This labyrinthiform condition of the nuclear area is not uncommon among the lower groups of teleosteans in the stricter sense, and is variably developed in *Elops.* In the characinid *Prochilodus rubrotæniatus* Schomb. the transition from the rugose or labyrinthiform nuclear area to the regularly circulate type is curiously shown, the area becoming multinucleate, with several small "islands" surrounded by circuli. *Albula vulpes* has large subquadrate scales, with about three basal radii, leading to deep emarginations of the base, which therein departs markedly from *Amia* and resembles the normal condition of many higher Teleosts. The subapical region is rugulose, very much as in *Amia,* but the true nucleus, just below it, is surrounded by fine regular circuli. It is in this small central region, above the nucleus, that *Albula* has genuinely transverse (concentric) circuli. It is also to be remarked that the basal circuli are all beaded in *Albula,* whereby they differ from *Amia,* but agree with the Osteoglossidæ.

Strong new interest in the Albulidæ has been aroused by the description of a new genus by Mr. Henry W. Fowler in *Proc. Acad. Nat. Sci. Philadelphia,* LXII. (1911), p. 651. This very interesting fish, *Dixonina nemoptera,* was found mixed with specimens of *Albula* from Santo Domingo, collected long ago by Gabb. Fowler writes of the scales that they are "cycoid, inner edges mostly crimped, outer or exposed edges thin or membranous and ragged, marked submarginally with a concurrent vertical ridge or striation, the true edge of the scale." I am greatly indebted to Dr. D. S. Jordan for an opportunity to study a couple of scales of *Dixonina nemoptera,* taken from the original type. They are about 8.5 mm. broad and long, and in structure agree perfectly with those of *Albula.* The nucleus with its concentric circuli, the beaded longitudinal basal circuli, the three basal radii and three basal emarginations, etc., are all the same. The dermal pigment spots also agree. In some ways this exact correspondence is rather disappointing, but it shows the conservative nature of the scale-pattern, and rather emphasizes its value as diagnostic not merely of the genus *Albula,* but of the group to which it belongs.

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The Significance of Lead Arsenate Composition

The control of a large class of the insect pests of growing crops depends on the use of arsenical sprays, and the commercial importance of such spraying has assumed very large proportions in recent years. Two factors determine the limits to which such methods may be carried with success. The first factor is the amount, character and timing of the applications necessary to control the insect. The second factor is the degree of toleration for the spraying treatments which the crop in question may possess. It is with the latter part of the problem that the following discussion is concerned.

Arsenic may injure plants quite as seriously as animal tissue, and the efforts of investigators have been directed towards preventing