different structure; it shows a somewhat irregular, more or less oblique and waving, but in general transverse, i. e. circular striation. These undulations are almost everywhere of two different kinds; larger, averaging in width from 0·01 to 0·022 mill., and smaller, between them, about 0·004, also only 0·007 mill. In many places the two systems are not distinct, and in others the undulations are mingled with similar figures of quite irregular form and distribution. On the youngest part, that is the inner end near the bulb, there is nothing of this transverse striation, but in its place a rather thick layer of spindle cells of about 0·006 mill. diameter, more or less transversely arranged, which become the longer and narrower as they are farther from the bulb, and it is evident that the circular striation is derived from these cells. Some acetic acid added brought to appearance the endoplasts (nuclei) in some of the cells, but not very distinctly; probably the object was not fresh enough.

It is to be expected that more such specimens will be found, also of other species of *Unionidæ*; for *U. ligamentinus* is hardly the only one to have a byssus long after the embryonic stage. And some points, in which my examination was not sufficient, may then be better ascertained.

CRITICAL NOTES ON EASTERN TEXAS UNIONIDÆ.

BY H. A. PILSBRY.

A collection of *Uniones* lately obtained by the writer from Mr. W. L. McDaniel of Tyler, Texas, has given new localities for a number of species, as well as occasion for notes on their synonyms and relationships.

The species of the southern Mississippi River, described originally from Louisiana, Mississippi and Arkansas, will mostly be found in eastern Texas, and constitute nearly the entire naiad fauna of that region. There are besides these, a few forms common to the whole Mississippi drainage, and found also in the Alabama basin, and a few peculiar to Texas and Mexico, the latter becoming more and more numerous as we travel southward.

Most of the characteristically Texan species belong to Mississippi River types, a circumstance which first struck me when working up

the *Uniones* collected by myself in Texas, during two visits some years ago.

In the matter of synonyms I have mentioned only such indisputable facts as have forced themselves to my notice while identifying the specimens in hand. Far more extensive name duplication exists in many cases.

It has been obvious to me for years that Lea's system of sections founded on contour, for the classification of *Unionidæ*, is hopelessly and radically wrong. It builds up false groups in about nine cases out of ten. Lea doubtless knew this as well as we, intending his system merely to be a convenient working guide. In this case, as in most others, the natural system will supercede the artificial, as it will, when well worked up, be found vastly more convenient.

One of the main characters of the new system will be *the sculpture of the beaks*, which is greatly varied in the different types, and remarkably constant specifically. The importance of collecting *young* with old specimens cannot be too strongly impressed upon the field naturalist. The character of being winged over the hinge-ligament is of minor importance. Lea's *alate* group including a number of very diverse types.

Among the more prominent groups represented in the collection here commented on, are the *group of U. plicatus;* the *group of U. parvus* (including *parvus, Bealei, Texasensis, Sayi, camptodon*, etc., etc.); the *group of U. pustulosus*, (including *Houstonensis*, and *nodiferus* below, and a number of northern species); the *group of U. alatus* (including *purpuratus, alatus, lævissimus*, etc., etc.)

The species are as follows:

U. plicatus Les. Leon Cr., Lee Co., Texas. Common and typical at least as far south as the Colorado River at Austin.

U. trapezoides Lea. Sabine River, Shelby Co., and Neches River near Tyler, Texas. Say's name *interruptus* has priority, despite Lea's assertion to the contrary, but it had better be dropped on account of the earlier *interruptus* of Rafinesque, Conrad, *et al.*

U. perplicatus Conrad. Big Eddy in Neches River near Tyler, Texas. Apparently distinct from the numerous plicate *Uniones* of Texas, many of which are mere varieties.

U. Chunii Lea. Big Eddy in Neches River near Tyler, Texas. Belongs to the *trigonus* group, but is far less angular. It is very variable.

U. castaneus Lea. Neches River near Tyler, Texas. A compact little shell, described originally from Alabama. Specimens from "Ouichita, Kansas" are also before me. Mr. Simpson called my attention to the identity of these specimens with the Alabama species.

U. Houstonensis Lea. West Yegua Creek, Lee Co., Texas. A smooth species of the *U. pustulosus* group. It is somewhat allied to *U. petrinus* Gld., an unfigured species of which *U. Bollii* Call is a synonym.

U. nodiferus Conrad. Big Eddy in Neches River near Tyler, Texas. Lea unites this with his *Schoolcraftii*, but it is apparently as distinct as most of the *pustulosus* group.

U. asper Lea. Kickapoo Creek, Henderson Co., and Neches River at Tyler, Texas. This Janus looks on one side toward *apiculatus* Say, and on the other in the direction of *lachrymosus* Lea and *fragosus* Con. Some queer episodes will sometime be revealed in the family history of the "*apiculatidæ*." The mingling of blood has been something scandalous.

U. tuberculatus Barnes. Neches River near Tyler, Texas. Some specimens have the tubercles arranged very distinctly in V-shaped rows, as in *Unio apiculatus* Say. In fact, *tuberculatus* belongs to this same group, despite its different contour. This shell is found throughout the Mississippi (including Ohio and Missouri) drainages, as well as in the Alabama River. Some southern specimens have the nacre pink, a character I have never observed in Northern shells.

U. Berlandierii Lea. Colorado River near Austin. This is very closely allied to *U. Tampicoensis* and *U. Tecomatensis* of Lea. Belongs to the group of *U. crassidens* Lam.

U. purpuratus Lam. Big Eddy in Neches River near Tyler, Texas. Stands between *alatus* and *coloradoensis*. Lea gives the correct synonymy.

U. Hydianus Lea. Kickapoo Creek, Henderson Co.; Neches River near Tyler, and Texarkana, Texas. An apparently distinct species of the *luteolus* type. Varies in color from black to yellow or red rayed with green. The males and females are notably dissimilar in form, as in *U. luteolus*, etc. Compare *U. approximus* Lea.

U. Bealei Lea. Near Forney, Texas. Closely allied to *U. Texasensis* Lea, but the teeth are much more compressed.

U. Texasensis Lea. Wimberly Lake, Lee Co., Texas. Allied to *U. parvus*, *U. Bealei*, etc. Lea's *U. Bairdianus* is a synonym.

U. Sayi Tappan. Texarkana, Texas. Allied to *camptodon*, but easily separable from the types of that species. *U. subcroceus* Con. seems to be the same.

U. camptodon Say. Water works reservoir, Tyler, Texas. I do not propose to go into the tremendous and involved synonymy of this member of the *U. parvus* group. Typically the *camptodon* is distinguished by the form of the hinge-line, which is decidedly curved under the beaks. Forms very similar are found from the Ohio River to East Texas and to Florida.

U. declivis Say. Sabine River, Shelby Co., Texas. More angular posteriorly than *U. symmetricus*. *U. geometricus* of Lea is a synonym, as Lea himself ascertained.

U. symmetricus Lea. A species allied to *declivis* Say, but less angular. It has much the general appearance of the common eastern *U. complanatus*. The synonymy of *symmetricus* includes *U. porrectus* Conrad, *U. manubius* Gould, and (according to Mr. Simpson) *U. Jamesianus* Lea. Mr. Simpson kindly compared specimens with the types of *symmetricus*, confirming my identification. The localities are Blackfork Creek, near Tyler, Texarkana, and West Yegua Creek, Lee Co., Texas.

U. subrostratus Say var. *Rutersvillensis* Lea. Texarkana; Wimberly Lake, Lee Co., Texas. The extensive synonymy of this species has been worked out by Prof. R. E. Call, (Bull. Washb. Lab.)

U. anodontoides Lea. Blackfork Creek near Tyler; West Yegua Creek, Lee Co., Texas. Exhibits no variation from the common Mississippi and Ohio River types.

Anodonta Stewartiana Lea. Neches River near Tyler. Belongs to the *A. corpulenta* group. *A. virens* Lea is probably a synonym, and *H. Linnæana* Lea is closely allied.

ON THE DISTINGUISHING CHARACTERS OF UNIO RADIATUS AND UNIO LUTEOLUS.

BY GEO. W. DEAN, KENT, OHIO.

In the September NAUTILUS, Rev. W. M. Beauchamp has the following queries: "Can any one point out an invariable feature

distinguishing *Unio radiatus* and *luteolus?* The distinctions do very well for some, but to others they seem a good deal mixed. Has not every collector some which he has not named?"

After long familiarity with *luteolus* in many streams and reservoirs and having several suites of *radiatus* from different localities, and seeing it plentiful in the Susquehanna River at Muncy, Pa., the thought has not come to me that they were even closely related; nor do I think they are. Sometimes there is an *indescribable* something plainly discernible to the eye of an expert that separates species, but there is no such difficult or intangible distinction in this case and I think I can make the distinctions plain to Mr. Beauchamp.

I can emphatically say that I have nothing at all like either species that is not easily named.

As a first distinction I give the *form of the female of luteolus* which at maturity becomes very broad and inflated at the posterior end and truncated, while forward it remains narrow and very small, comparatively. This characteristic I have not seen in *radiatus* and do not think it exists. The difference between the male and female is so great in *luteolus* that Anthony thought them distinct and gave to the male the name of *U. distans.*

Another and very marked difference is in the epidermis. In *luteolus* it is, in its perfect state, polished and hard as glass, giving to the radiating stripes a distinctness rarely seen in the genus. While the lines of growth in *radiatus* are very much larger, giving the surface to the naked eye more the appearance of velvet or fine plush also giving to the radiating stripes a corresponding dimness. Of course these distinctions in the epidermis come out only in cleaned shells or young specimens naturally clean; they would not be noticed in mature shells as taken from the water. But even in this state I should readily distinguish either species as it came to the light. If there is such a thing as an intermediate specimen, I should like to see it and would agree to put it in the right place at sight.

As a third distinction, the range of color in the nacre of *radiatus* is very great, whilst in *luteolus,* as far as I have seen, it is uniformly light-blue. I have heard of *luteolus* with pink nacre but have never seen one. I do not know either whether these two species are ever found together.