therefore, be visible to us if the length of the multiple lies between 0.38 and 0.76.

If, therefore, for botanical, physiological and bacteriological work we stain our preparations with fluorescent substances and illuminate with ultra-violet light, we shall bring into prominence smaller particles or structures than can possibly be seen with the ordinary white or colored light. Or, if we prefer, instead of the retina we may expose a sensitized plate, especially one that is sensitive to the particular fluorescent waves excited by the special ultra-violet light that we employ.

But the success of this modification of the ordinary methods depends also upon having our microscope lenses so ground as to correct for the particular waves that we are employing. In fact, one may conceive that an ultra-violet wave of, for example, 0.09 microns may by fluorescence excite a wave of 0.18, or 0.27, or 0.36 microns, and will, therefore, still be invisible to the eye, while perfectly competent to do photographic work. It will, therefore, be a great labor to grind the lenses properly, since their perfection can only be tested by experiments with invisible fluorescent rays; but when perfected these lenses and the photographs give us a power of what we may at present call 'ultra-microscope research.' The development of such work is limited only by the chemical and physical properties of atoms and molecules, and is not in any way affected by the limitations of the human eye.

The first steps toward realizing this advance in microscopy will naturally be made with the ordinary microscope, and the ordinary soluble fluorescent substances, among which we recall eosine, thallene, quinine, æsculine, chlorophyll, magdala red. If now with the fluorescent staining and ultra-violet illumination we combine the principles of the schleier method it would seem that there will in the future be no limit to the powers of research, except that which is set by the diffraction phenomena. The ultimate limit of actual photographic visibility will be of the dimension of one or two of the very shortest wave-lengths of ether, or of the same dimensions as the larger molecules themselves.

It is possible that Professor Ernst Abbe, of Jena, and his colleagues have been working along some line of thought similar to the preceding, as I notice that in the list of scientific instruments in the German educational exhibit at the St. Louis Exposition, page 213, mention is made of the ultra-microscopic work, but from what little is stated it would seem possible that this refers especially to the ordinary microscope combined with the schleier method; I have not as yet learned of any details and may be entirely wrong. The flood of ultra-violet light given out by the soft-iron electrodes of Dr. Piffard's tube and the magnificent fluorescent effects displayed by Mr. Geo. F. Kunz in his lectures suggested to me the preceding combination of fluorescence, the schleier method, and the microphotograph, and I have been encouraged to publish the idea.

To-day an interview with Dr. Sigfried Czapsky, a colleague of Professor Abbe's, has brought to my attention the fact that great improvements in ultra-microscope work are in progress at Jena, but not yet sufficiently developed to justify publication. I have, therefore, taken the liberty of sending you this communication in hopes that there will be some suggestion in it worthy the attention of these eminent opticians.

CLEVELAND ABBE.

WASHINGTON,
November 6, 1904.

EXTINCT PEDICULATE AND OTHER FISHES.

WHILE engaged on chapters relative to the Pediculates for a work on fishes, I was extremely pleased to receive just what I wanted —further information respecting the former history of the order. I had received from Dr. C. R. Eastman an interesting 'Bulletin of the Museum of Comparative Zoology' entitled 'Descriptions of Bolca Fishes.' In that were figures and description of a form referred to '*Lophiidæ*' and named *Histionotophorus bassani* (Zigno). A close examination of the reproductions of photographic figures, however, convinced me that the fish was not one of the lophiids but a typical antennariid. The mode of fossilization showed that it was a com-

pressed fish and the structure and relations of the fins to each other and the interspinals, as well as other skeletal details, conclusively demonstrated that the animal was closely related to the existing *Antennarius* and *Pterophryne*. Indeed, with skeletons of those forms before me, after elimination of faults of restoration, I could find no generic differences between the fossil and the recent *Pterophryne*. The caudal of the extinct species, it is true, was longer and that difference may be correlated with others observable by close scrutiny, but the figures published do not give details with sufficient clearness to appreciate them.

Still more apt than Dr. Eastman supposed, then, are his remarks: "Attention should be called * * * to the remarkable fact of a type of fish-life appearing suddenly in the Eocene, already highly modified, without any known predecessors nor any that can be plausibly conjectured, but which persists after its first introduction essentially unchanged until modern times."

The recognition of the relationship of '*Histionotophorus*' accentuates the deduction. We now have two (the only known) eocene Pediculates so nearly related to greatly differentiated recent forms that their generic differences, if any, remain to be discovered—the *Lophius brachysomus* and *Histionotophorus* (perhaps *Pterophryne*) *bassani*. Yet the Pediculates are exceptionally aberrant and specialized fishes. The significance of the facts may be appreciated when it is recalled that nearly all the contemporary mammals belonged to extinct families or, conversely, that almost all the recent families have been evolved since—so far as we know.

The history of the form is noteworthy. De Zigno (1887) recognized its similarity to the genus *Antennarius* (Questa forma * * * presenta qualche somiglianza col genere *Antennarius* di *Commerson*) but distinguished it by its form, horizontal mouth and elongated fin-rays, especially those of the caudal. Smith Woodward, without reference to the views of De Zigno, noticed it, among the 'Scorpænidæ,' as one of the 'extinct genera and species, which are not represented in the collection, [and] are supposed to be related to *Scorpæna*.' Eastman's view has just been given. It only remains to add that no such differences as are urged by De Zigno exist, except the long caudal rays. The horizontal mouth is the result of distortion through pressure. The figures marked on Eastman's plate (I.) '1.' and '1a' show the subvertical mouth.

One more of several points raised by Dr. Eastman's important memoir may be alluded to.

Another Monte Bolca fish has been described and photographed as *Symphodus szajnochæ* (= *Crenilabrus szajnochæ* Zigno). The non-labrine appearance and osteological characters led me to read the description. It appears, according to Dr. Eastman, that 'there are at least eight branchiostegal rays' and that 'the scales are thin, ctenoidal and very strongly pectinated.' It is, therefore, evident that the species is not even related to the labrids. The characters specified are rather those of berycids, but it belongs to no known genus and the family even is uncertain. The combination of form, rounded caudal, single dorsal with eleven stout spines, and anal opposite soft dorsal, with ctenoid scales and increased branchiostegal rays, separate it from any other fish, so far as known, and it may be differentiated as a distinct generic type and named *Bradyurus*. It is to be hoped that Dr. Eastman may reexamine the fish and give the results of his review.

Theo. Gill.

THE RE-DISCOVERY OF DINOMYS.

The great rat-like rodent *Dinomys* was discovered in 1873 in the Peruvian Andes, and since that time the specimen, which is preserved in the Berlin Museum, has remained unique. In the spring of this year Dr. Goeldi, of the Museum of Para, announced the rediscovery of this rare animal in the lowlands of Brazil. The following notes as to its appearance and habits are abridged from Dr. Goeldi's account of this animal which appeared in the *Proceedings of the Zoological Society* for May and June.

The general build of *Dinomys* is thick-set and inclined to corpulency. Due to the fact of setting