of its nucleus. If then the facts drawn from the observation of parasitic Hymenoptera apply equally to the higher animals, it will be inexact to speak, as has sometimes been done, of an embryonic period which is indifferent from the sexual point of view. The indifference is probably apparent rather than real, and it appears probable that once fecundation is effected the sex is irrevocably fixed.

It is strange that Marchal's work and that of Silvestri following it have received so little attention from English-speaking naturalists.

The extraordinary nature of the discoveries and their wide bearing upon profound biological problems render them among the most important discoveries in biology of recent years. Recently published volumes on insects contain no mention of them; no competent reviews have been published in American or English journals, so far as I am aware, and it is for the sole purpose of directing the attention of American workers to this extremely important field that I have written this lengthy account. After reviewing one of Marchal's preliminary papers in SCIENCE in 1898, I endeavored to induce several university teachers, possessing well-equipped laboratory facilities, to take up the subject of this investigation, but without success. It is a fertile field. In the parasitic Hymenoptera there are many thousands of species, and an unlimited material exists at our very doors. The most promising fields of investigation have recently been pointed out by the writer in a paper read before the Entomological Society of Washington. Marchal has studied two or three species; Silvestri has studied another; and both workers have found radical and interesting differences in all. There is, therefore, a vast and unexplored field whose richness can well be predicted from the results of Marchal's work. L. O. HOWARD.

LE FONDULE (FUNDULA CYPRINODONTA) OF CARBONNIER AN UMBRA.

I HAVE been several times asked what the Fondule of Carbonnier (1874) was. The breeding habits of this American fish were noticed in considerable detail by P. Carbonnier in the *Bulletin Mensuel de la Société d'Acclimatation* for November, 1874 (pp. 665–671), but under a strange name which has evaded and even prevented identification. The article in question is entitled 'Le Fondule (*Fundula cyprinodonta* Cuv.)' and it is especially claimed: "Ce poisson américain a été désigné par Cuvier sous le nom de *Fundula cyprinodonta.*" But Cuvier never gave such a name to a fish, neither in the first or second edition of the 'Régne Animal,' nor (with Valenciennes) in the 'Histoire Naturelle des Poissons.' Carbonnier was probably told by some one who looked casually at his fish that it was a *Fundulus,* a cyprinodont, but the slight notice given of it by Carbonnier does not agree with any cyprinodont. The only means he has given to determine what it was are meager data respecting size, color, sexual differences and habits. The size was small—12 to 15 centimeters at most; there were numerous longitudinal parallel lines; there was no constant difference in color between the sexes, but the females were twice as large (bulky) as the males; they were noticeable for immobility[1] and also for apparent power to turn the head.[2] Here we have a combination of characteristics which is not true of any cyprinodont but which is on the whole realized by an Umbra or mudfish (*U. pygmæe*), and doubtless specimens of that mudfish (to be found abundantly about New York) were the fishes sent to Carbonnier. The sender was a 'M. Godillot,' a Frenchman doing business in New York, as appears from a previous notice by Carbonnier in the *Bulletin* (1871, p. 650).

Interesting details are given of the play of the sexes, the change in color during the nuptial season, the mode of oviposition, the care of the female for her eggs[3] and the char-

[1] L'immotilité qui est un caractère de cette espece (p. 666).

[2] J'ai dit elle tourne la tête, et avec intention, car cet organe chez le Fondule paraît ne pas être invariablement soudé à la charpente du tronc, et jouit, au contraire, d'une certaine mobilité (p. 669).

[3] Pendant tout le temps que dure l'incubation, qui est de treize à quatorze jours, la femelle veille avec une tendre sollicitude sur ses œufs (p. 669).

acteristics of the larval fish. These were the first observations made on the breeding *Umbra* and should be repeated before they are fully accepted. Although many years ago I kept several specimens in a small aquarium, no attempt to breed was noticed, and none has been observed in an aquarium of the U. S. Fish Commission containing a number of them. I therefore call attention to the interesting article by Carbonnier.

THEO. GILL.

NOTES ON PHYSICS.

THE TUNGSTEN LAMP.

MANY readers of SCIENCE may be interested to know that 'the electric lighting industry is face to face with a change of almost revolutionary character,' to quote from the concluding paragraph of a paper read before the American Institute of Electrical Engineers by Dr. C. H. Sharp, of the Electrical Testing Laboratories of New York City, on Friday evening, November 23.

The two papers of the evening were, a paper by Dr. C. P. Steinmetz on the general aspects of the problem of the transformation of electric power into light, and one by Dr. Sharp on some tests of new types of incandescent lamps; and the subject was discussed by several investigators who are working upon the problem of the tungsten lamp in this country.

It is generally conceded that within a year an electric glow lamp, the tungsten lamp, will be on the market and that the output of light per unit of power consumed will be increased at least threefold above that which is now obtained by the carbon filament glow lamp; which means that the light-producing capacity of every electric lighting station in the world will be at once multiplied by three, and that there will be at once the possibility of greatly reduced prices per unit of light and greatly increased profits to the electric lighting companies.

Those who are interested in the scientific or technical aspects of the problem of electric lighting will find it worth their while to read the papers of Dr. Steinmetz and Dr. Sharp in the forthcoming monthly issue of the *Proceedings of the American Institute of Electrical Engineers.*

NORMAL VERSUS SELECTIVE RADIATION. SELECTIVE EXCITATION.

To obtain a highly efficient lamp is either to discover a substance which will stand an excessively high temperature under which conditions a very large percentage of the radiant energy is light, or to discover a substance which at a moderately high temperature radiates selectively and gives off a large percentage of luminous radiation. Thus the Welsbach gas light owes its high efficiency very largely to the selective radiation of thorium and cerium oxides.

The idea of selective radiation is, however, profoundly modified in most illuminants and made to depart widely from that form of the idea which is based upon thermodynamics, where the idea grows out of the necessarily complementary character (in a substance nearly in thermal equilibrium) of emission, transparency and reflection.[1]

This modification of the idea of selective radiation is so important in the problem of light production that it should be more generally recognized, and its very intimate connection with that principle in the kinetic theory of gases which is known as the principle of the equi-partition of energy should be pointed out. Indeed, this modification of the idea of selective radiation is intimately connected with the apparent inapplicability of the principle of the equi-partition of energy.

Jeans has shown that the apparent failure of the principle of the equi-partition of energy in a gas may be explained by the hypothesis that when energy is given to a gas in a particular form, say as energy of translational molecular motion, it takes a very long time for this energy to become properly partitioned among all the possible modes of molecular motion.

The application of Jeans's idea to the question of selective radiation is that when energy

[1] See Nichols & Franklin's 'Elements of Physics,' Vol. III., chapter on Radiation for an outline of the argument.