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eggs any trace whatever of centrosome or archoplasm in connection with either nucleus. In more favorable sections at this stage, however, an archoplasmic field, very faint at first, but later showing centrosomes and radiations, is observed by Wheeler lying close to the egg nucleus, but no indication of such structures is found near the sperm nucleus. Kostanecki's observations, on the other hand, are precisely the reverse, the centrosome and archoplasm, when visible at all, being seen just outside the membrane of the sperm nucleus, while nothing of the kind accompanies the egg nucleus.

Here we are confronted by totally contradictory observations of two able investigators, working on the eggs of the same species of animal, and until one or the other author is confirmed by future study of the fertilization of the egg of *Myzostoma glabrum* judgment in this case will have to be withheld.

The doubt which Wheeler's work, of late the sole remaining contradiction, has seemed to cast on the universal validity of Boveri's view throughout the animal kingdom is, at all events, greatly diminished by the recent publication of Kostanecki. GEORGE LEFEVRE.

**Plankton Studies on Lake Mendota.**<sup>1</sup>—This paper, being a report of the continuation of Professor Birge's work on Lake Mendota, is by far the most important American contribution, to our knowledge, of the biology of lakes. It contains the results of observations and collections made at maximum intervals of two weeks during a period of two years and a half. These observations have been worked out with infinite care and patience, and the conclusions are of very great interest. The author does not maintain that the conclusions are in all cases final, as, indeed, that would be impossible, because of the very complex character of the problems attacked. But he certainly is to be congratulated on the amount he has been able to accomplish.

It is impossible for a reviewer, within any reasonable limits, to treat of the paper, for, while it is a somewhat bulky production—covering 174 pages of the eleventh volume of the *Transactions of the Wisconsin Academy*—it is really so much condensed that one cannot make an abstract of its contents. All that can be attempted is to indicate the subjects treated.

After a brief discussion of the methods employed in the investigation, the divisions of the paper are taken up in the following order:

<sup>1</sup> Plankton Studies on Lake Mendota. II. The crustacea of the plankton, July, 1894–December, 1896. By E. A. Birge, Professor of Zoology in the University of Wisconsin. *Trans. Wisconsin Acad. Sci.*, vol. ii.

temperature, annual distribution of crustacea, with a discussion of the factors controlling annual distribution, vertical distribution, and a discussion of the factors controlling vertical distribution.

In treating of temperature, Professor Birge proposes the term *thermocline* as the equivalent of the German *Sprungschicht*, a happily chosen word, which will, doubtless, have a permanent place in scientific nomenclature. The thermocline is that layer of water in which there is a sudden change from the warm temperature of the surface to the cooler temperature of the lower waters. The thermocline lies at a depth of from eight to ten meters, and at this point there may be a change of as much as nine degrees in a single meter. The position of the thermocline is somewhat variable, being determined not simply by convection, as is intimated by most German authors, but also by the effect of the wind. It follows that the thermocline will be higher in a lake protected from the winds than in a larger body of water.

The author then gives a detailed account of the annual distribution of the forms of crustacea found in Lake Mendota. His results are not entirely in accord with the observations of European authorities or with those of the reviewer in Green Lake. It is perhaps remarkable that the agreement should be as great as it is, when we consider the differences in environment of the lakes.

The factors of annual distribution are stated to be food, temperature, and competition. It follows because of variations in the amount of food and the yearly changes of temperature, with a general correspondence between successive years, that there are yet marked differences. He finds evidence of competition in the fact that certain species are predominant at times to the exclusion of others, this being explained on the assumption that the water can support only a certain number, and that the first species that gains control of the field will inevitably exclude others.

In speaking of the vertical distribution of crustacea, he records observations on the migration in the upper meter, finding evidence of a very distinct diurnal migration within narrow limits. He finds, too, that the thermocline seems to be the lower limit of the vast majority of crustacea, only a few forms being found in abundance below that point.

In the account of the vertical distribution of individual species there are many interesting facts. He finds the distribution of *Diaptomus* very different from that reported of the *Diaptomi* of Green Lake. This does not seem to me strange, for the *Diaptomus*

of Mendota is *D. oregonensis*, while that of Green Lake is *D. minutus*, a species of very different habits. It should be noted, too, that the Diaptomi are especially susceptible to the influences of the environment, and we must expect the different species to have their own peculiarities.

He enumerates eight factors which determine vertical distribution, *viz.*: (1) food, (2) temperature, (3) condition of water in regard to dissolved oxygen and other substances, (4) light, (5) wind, (6) gravity, (7) the age of members of any given species, (8) specific peculiarities.

Of these factors, the third is one of great importance, which has received very little attention from preceding authors. Professor Birge states that he is unable to state whether the lack of life in the lower waters of Mendota is due to a lack of oxygen or to a large amount of the products of decomposition. It has seemed to the reviewer that it was very probable that the products of decomposition have very much to do with the lack of life in many lakes, for, in an examination of a number of the Wisconsin lakes during the last summer, it was noticed that the deep lakes of small area had a large amount of organic matter on the bottom and almost an entire lack of animal life, while in the larger lakes with less organic matter there was a considerable abundance of animals. The other factors are discussed with considerable fullness. It is shown that gravity has a marked influence on the vertical position of crustacea, as it is only by considerable effort that they maintain their vertical position, and that, as they grow old or are enfeebled for any cause, they gradually fall to lower levels. Under seven it is shown that the young crustacea appear in greater numbers near the surface. The young of the copepods form an exception, however, for they appear in the greatest numbers near the thermocline.

In conclusion, the reviewer must again express his regret that it is impossible to do justice to the paper within the limits of ordinary review, and considers that he has done as well as could be expected if he has succeeded in making evident the value of the investigation.

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#### BOTANY.

**Lessons with Plants.**<sup>1</sup>—In recent years there has been a great multiplication of books designed to render the study of botany attrac-

<sup>1</sup> *Lessons with Plants: Suggestions for Seeing and Interpreting Some of the Common Forms of Vegetation.* By L. H. Bailey. With delineations from nature