

sarily too many names and too many, and often too fine, distinctive characters. In a seminar one group after another can be taken up. Each member studies one group, familiarizes himself with the characteristics, data, life histories, etc., and gives his demonstration. In a beginners' seminar the main groups may thus be treated; in an advanced seminar a small group may be studied more completely, and the members will have an opportunity to familiarize themselves with the main literature on the group, etc.

(3) A seminar can give the student an opportunity to see and compare more material than is possible in the laboratory course, and to see it better than is possible in a lecture or in the few minutes just before and after the lecture. The knowledge and faculty of observation gained by previous laboratory work enables the student to get a great deal out of the demonstration of comparatively much material which passes through his hands in a seminar. A student may have had, say a course in the dissection of an animal, the frog or the cat, for instance, and he may also have taken a course in comparative anatomy, and dissected a number of types such as *Amphioxus*, *Petromyzon*, a teleost, an amphibian, a reptile, a bird and a mammal. Then in a seminar it may seem desirable to study the different groups of fishes or amphibia more carefully. Each member makes a preparation of one system, or of all the systems of one animal, and gives his talk and demonstration on it. (Some of the better dissections may then be added to the museum.) Some skillful member may even be trusted with a dissection of a cæcilian, or the instructor may do that himself. Or the sexual organs, the nervous system, may be taken and studied in the seminar by means of demonstrations, microscopic slides and talks prepared by the individual members. Such a series for the sexual organs would be: *Petromyzon*, *Myxine* and *Bdellostoma*; *Amia*, *Lepidosteus* and *Acipenser*; Teleosts: *Perca*, *Salmo* or *Esox* for the male, *Perca*, *Esox* and *Salmo* for the female, *Serranus*, *Embiotocus*; *Protopterus* and *Ceratodus*; *Scyllium*, *Mustela laevis*, *Raja*, *Chimæra*; *Necturus*, *Cryptobranchus*, *Diemyce-*

*tilis* and *Triton*, *Amblystoma*, *Plethodon*, *Rana*, *Bufo*; cæcilian; snake, turtle, lizard, crocodile; bird; *Echidna* and *Ornithorhynchus*, marsupial, rabbit, cat, bat, monkey, man.

(4) Each member may work his studies into a little written composition which afterwards circulates among all the other members, who may add remarks and ask questions, and is finally handed in to the instructor. This work, it seems to me, is much more valuable to the students than keeping note-books. As we all know, note-books are a very doubtful means of education. They do not prove that the student has mastered the subject, for we have often seen students coming together and one of them dictating what the others put down with little individual changes. In other cases, the temptation of copying from books is too great. Under these circumstances, it seems an enormous waste of time for the student to say in his imperfect way what others have said ten times better, more clearly and correctly, and what he ought to read, or to have read, along with his studies, just as well as for the instructor to spend his time in correcting them, which he ought to spend in doing original work. The seminar obliges the student to work a subject up, making himself thoroughly familiar with it, and then present it in a way which, while it is not original research, certainly means an individual representation, and, as such, is an important step towards independent work.

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#### BOTANICAL NOTES.

##### STUDIES OF WATER MOLDS.

DR. BRADLEY M. DAVIS, of the University of Chicago, has just issued a quarto pamphlet of thirty-two pages, accompanied by two large plates devoted to the oogenesis of certain species of water molds (*Saprolegnia*). The paper appears as one of the Decennial Publications of the University of Chicago, and is well worthy of appearing in this notable series. The treatment is modern, and Dr. Davis is quite inclined to cut across some of the views which have fastened themselves

upon the morphology of the water molds and their relatives. While it is impossible to summarize this paper here, the present reviewer wishes to express his hearty agreement with the conclusions reached by the author.

#### PROTOPLASMIC STREAMING IN PLANTS.

DR. ALFRED J. EWART, of the Birmingham Technical Institute, England, has recently published an interesting book on the physics and physiology of protoplasmic streaming in plants which will attract the attention of cytologists and no doubt help to give a better idea of the mechanism of the streaming cell. The work is the outcome of a series of observations begun nearly ten years ago by the author and continued until quite recently. It takes up first the physics and chemistry of the subject, and this is followed by the physiology, and then by a theoretical and general discussion. A few results may be summarily indicated as follows:

The movement is generated in the protoplasm itself.

The velocity of streaming is largely dependent upon the viscosity of the protoplasm, and hence upon the percentage of water, being more rapid as the water is increased.

Gravity exercises little or no influence upon streaming in small cells, and only a very slight one in large cells.

High temperature affects streaming by decreasing the viscosity, and for each species of plant or cell there are minimal, optimal and maximal temperatures.

No special chemical changes are connected with the streaming of protoplasm.

In the strongest magnetic field little or no effect on the streaming is noticed, but electrical currents may accelerate or, when strong, stop the movement.

Strong light retards streaming, while weak light may accelerate it under certain circumstances.

The book is one which must commend itself to plant physiologists.

#### FORESTRY IN NEBRASKA.

SEVERAL years ago the Nebraska Park and Forestry Association was organized for the purpose of encouraging tree planting for economic as well as ornamental purposes. This organization has just issued a 'Park and Forestry Manual' which calls attention to the kind of work which such an organization may do for a community. This little manual of nearly one hundred pages contains many suggestive articles. There is first a short article giving the origin of arbor day, followed by one on the 'Forests and Forest Trees of Nebraska.' Following this is another on 'Tree Planting on Nebraska Prairies,' and then in succession 'Propagation of Forest Trees,' 'Raising Evergreens from Seed,' 'The Nebraska Forest Reserves,' 'Tree Planting in School Yards,' 'Trees and Orchards,' 'Success or Failure in Timber Claim Planting and Causes for It,' 'Home Adornment and Public Parks,' 'The Red Cedar for a Screen or Shelter' and 'Annotated List of Nebraska Trees.' This manual might well be imitated by similar organizations in other states.

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#### MODERN VIEWS ON MATTER.\*

THE Romanes lecture was delivered in the Sheldonian Theater, Oxford, on June 12, by Sir Oliver Lodge, F.R.S., principal of the University of Birmingham, the subject being 'Modern Views on Matter.'

The lecturer began by saying that he would discriminate between theses which were generally accepted by physicists and speculative opinions or hypotheses which were now being thrown out on the strength of experimental evidence of an at present incompletely conclusive, but very suggestive, character. The first thesis was that an electric charge possessed the fundamental property of matter, called mass or inertia, and that if a charge were sufficiently concentrated it might represent any amount of matter desired. There were reasons for supposing that electricity

\* From the London *Times*.