then can be the value of this classification, out of sympathy with the purposes of morphology on the one hand and the spirit of natural history on the other?

The illustrations are photographs of mounted algae on cards, and in some cases of preparations slightly magnified. While many are clear others seem to the writer quite valueless as a means of identification and unworthy of the book. Although the color of the specimen would help in this mechanical matching of mounts with figures, nevertheless there is sure to be much confusion. For example, how is *Enteromorpha clathrata* to be distinguished from certain Cladophoras? The figure of *Ectocarpus viridis* might do for several other species, the Callithamnia are quite impossible, and *Polysiphonia fastigiata* is certain to be confused with Sphacelaria.

One occasionally finds statements that lead to the belief that the author is quite untrained in natural history. Thus, on page 29 is the phrase "*Ectocarpus Hooperi*, a species of Ectocarpus first described by Mr. Hooper." This does not seem to be a fact, and the impression conveyed that naturalists name species after themselves is an implication of conceit far from being warranted by the conduct of these modest members of society.

The book has yet to be written that will tell the natural history of seaweeds with the charm of manner shown in the style of Miss Margaret Morley. And until such a treatment appears, it is much better that the amateur collector and observer of marine algae read Murray's *Introduction to the study of sea-weeds*, a simple and very interesting account, and one thoroughly grounded in science.— B. M. DAVIS.

NOTES FOR STUDENTS.

PROFESSOR ARNOLDI[2] has taken up the somewhat incomplete work of Shaw, and has made a careful study of the development of the endosperm of *Sequoia sempervirens*. Free nuclear division takes place in the usual manner in an evenly distributed peripheral layer of protoplasm, but very soon there is a denser accumulation of protoplasm at the lower end of the sac. When the formation of walls begins, three regions of the endosperm may be distinguished, the upper, the lower, and the middle. The upper, and particularly the lower, develop faster than the middle, so that the ends of the sac become filled with a solid tissue while the nuclei are still almost free in the middle portion. Each nucleus of the middle portion now becomes surrounded by a wall which is open on the inner side: the walls grow inward and when the center is reached, walls are formed at the inner ends of the cells. The nucleus now begins to divide, and each of these cells ("alveoli") becomes divided into several cells. Archegonia are formed only from these

[2] ARNOLDI, W.: Beiträge zur Morphologie einiger Gymnospermen. I. Die Entwickelung des Endosperms bei *Sequoia sempervirens*. Bull. des Natur. de Moscow. Pp. 1–13. *Pls. 7–8.* 1899.

alveolar cells of the middle region. At the time of fertilization, the upper and lower portions of the endosperm consist of small-celled tissue, while the middle portion is alveolar. Sequoia is regarded as a connecting link between Gnetum and the angiosperms on the one hand and between gymnosperms and the archegoniates on the other.

In a later paper[3] he has described the archegonia and pollen tubes of the same species. The archegonia are very large, and some sections show as many as sixty. They sometimes occur singly, but are often grouped. In development they resemble the archegonia of the Cupressineae, since they are often in direct contact with each other and do not form any ventral canal cell. There are no proteid vacuoles. The neck consists of two cells, in this respect resembling the older gymnosperms.

The pollen tube grows through the nucellus, not between the nucellus and integument, as described by Shaw. At the time of fertilization the pollen tube contains the two male cells of equal size, and two small nuclei, one of which is the tube nucleus and the other "the nucleus of the cell which united the generative cell with the microspore wall." The general structure of the pollen tube and its contents agrees with the Cupressineae. The morphological considerations, together with the geographical distribution, lead to the conclusion that Sequoia is nearly related to the ancient type from which the modern Araucarias and Cupressineae have descended.—CHARLES J. CHAMBERLAIN.

CONNECTING THREADS which establish protoplasmic continuity between adjacent cells have been studied by Mr. Hill[4] in the embryo and seedlings of *Pinus pinea* and in the mature tissues of *P. silvestris*. Some attention was also paid to the endosperm of *P. pinea*. The endosperm consists chiefly of rather large rounded cells, but a close examination shows that in many cases an internal division has occurred. The threads are evenly distributed in the young walls, but are grouped in the older walls. Near the cotyledons the cells are smaller, the threads thicker, and there are traces of ferment action. Ferments from the cotyledon pass into the endosperm through the threads, and by the same route food materials pass from the endosperm to the embryo.

In the seedling the absorptive side of the cotyledon is more abundantly supplied with threads than the side not exposed to the endosperm. There

[3] ARNOLDI, W.: Beiträge zur Morphologie und Entwickelungsgeschichte einiger Gymnospermen. II. Ueber die Corpuscula und Pollenschläuche bei *Sequoia sempervirens*. Bull. des Natur. de Moscow. Pp. 1–8. *Pls. 10–11.* 1899.

[4] HILL, A. W.: The distribution and character of connecting threads in the tissues of *Pinus silvestris* and other allied species. Phil. Trans. Roy. Soc. London B. **194**: 83–125. *pls. 31–35.* 1901.

are no threads in the external walls of the epidermis, and but very few connecting the guard cells with their neighbors.

All parenchyma cells show a general resemblance in the character of their threads, the threads on the end walls being irregularly scattered, while on the side walls they are grouped. In the phloem all the sieve tube threads show a characteristic median dot. The albuminous cells at the edge of the phloem of the leaf have their threads grouped in localized thickenings on the walls, and serve to pass materials from the mesophyll to the phloem. The very numerous threads of the root cap form a connection with the free surface of the root and with the periblem.

In the mature tissue of *P. silvestris* the threads in the cortical tissue are similar to those of the seedling. In the phloem there is no connection between the sieve tubes and the bast parenchyma or the starch medullary ray cells. The sieve tube threads on the radial walls have a median dot. The torus of the bordered pit is probably traversed by threads which soon disappear. In the leaf, the distribution is about the same as in the cotyledon. The endodermis, with very numerous threads, is in close connection with the cortex and the stele. In the pericycle, living cells are connected by threads, but there is no connection between the pericycle and the lignified transfusion tissue.

In general, the main direction of threads in the cortex and phloem is tangential. The transitory nature of certain threads explains the absence of threads between the sieve tubes and medullary ray cells. Except in the medullary rays and in the cork cambium, the threads are chiefly on the radial walls. This suggests that in conifers food supplies and stimuli are conducted mostly in a tangential and vertical direction.—CHARLES J. CHAMBERLAIN.