type of embryo sac, as a basis of comparison with the other species to be described later. His topics are as follows: habit and vegetative structure, development of the spike and flower; the stamen, microspore, and pollen tube; the carpel and fruit, ovule and seed; the embryo sac, embryo, and endosperm; germination; and abnormal embryo sacs.

It is a very full and satisfactory presentation of the facts, on the basis of which the following conclusions are reached. In vegetative structure, *P. hispidula* is simpler than any of its relatives, and its delicate herbaceous stem, as well as the accompanying structures, are probably due to recent modification of the more complex type of structure. The flowers are naked, and there is no evidence that they ever possessed a perianth. The megaspore mother cell develops a tetrahedral tetrad of megaspores, whose delicate walls soon disappear, leaving the 4 nuclei in a continuous protoplast. The 4 megaspore nuclei divide to form the characteristic 16-nucleate embryo sac, with its egg and solitary synergid, and its huge endosperm nucleus, formed by the fusion of 14 nuclei. This embryo sac cannot be regarded as primitive, but rather as a compound sac, a structure unknown among the simpler forms. The restriction of the function of the endosperm to that of a "nurse" for the embryo, the food supply being stored in the perisperm, is regarded as "the next to the last step in the disappearance of the endosperm," which becomes practically complete in the Helobiales, Orchidaceae, etc.

To the reviewer, this study is a most satisfactory illustration of the fact that many conditions which appear primitive upon superficial examination may prove upon real examination to be derived and specialized conditions. —J. M. C.

Peridium formation in the aecium.—KURSSANOW[12] adds several interesting details to former accounts of the process by which the layer of peridial cells is formed over the outer surface of the developing mass of aeciospores. It had formerly been held that no intercalary cells were formed in the peripheral chains that constitute the lateral walls of the peridium, and that the peridial cells that make up these chains were metamorphosed aeciospore initial cells that had failed to divide. KURSSANOW finds, however, that intercalary cells are normally produced in these peripheral chains as well as in the interior aeciospore chains. They are not intercalary in position, but are cut off at the lower outer corner of the initial cell when this cell is about the third from the base of the chain. They enlarge somewhat after their abstriction, but soon become disorganized and form a structureless, gelatinous layer between the outer wall of the peridium and the sterile tissue that surrounds it. The production of intercalary cells was more readily followed and the cells were more persistent in the deep-seated, cylindrical aecia of *Puccinia graminis* and *Gymnosporangium tremelloides* than in any of the other 8 species with cupulate

[12] KURSSANOW, L., Über die Peridienentwicklung im Aecidium. Ber. Deutsch. Bot. Gesells. **32**:317–327. *pl. 6. figs. 2.* 1914.

aecia that were studied. In agreement with others he finds that the cells of the central arch of the peridium are the apical cells of the central spore chains that have, before their metamorphosis into peridial cells, cut off intercalary cells below. All of the cells of the peridium are therefore morphologically aeciospores. An apparent exception to this was found in *Peridermium Pini.* In the division of the peridium initial cells of the central arch the usual process is reversed and the small intercalary cell is cut off above and the peridial cell below. A brief description of the fertilization processes in this species is given. Equal cell fusions similar to those first described by CHRISTMAN were found.—F. D. FROMME.

Reciprocal crosses of Oenothera.—DAVIS[13] has reported a partial confirmation of the results obtained by DE VRIES from reciprocal crosses between *Oenothera biennis* L. and *O. muricata* L. The observations of DAVIS also include reciprocal crosses between *O. biennis* L. and *O. franciscana* Bartlett, between *O. biennis* and *O. grandiflora* Solander, and between *O. muricata* L. and *O. gigas* De Vries. Detailed, parallel descriptions are given of the parents and of the pairs of reciprocals, together with numerous photographs of the plants in various stages of their growth. Except in the case of the *gigas-muricata* crosses, the reciprocals of which were in general without important distinguishing characters, the reciprocal crosses exhibited striking contrasting differences. In most respects the crosses closely resembled the pollen parent (patroclinous), as had been noted earlier by DE VRIES for one of these crosses, but strong matroclinous tendencies were also observed, particularly in certain features of the inflorescence of the *biennis-muricata* crosses. Red coloration was found to be wholly or partially dominant without respect to whether it was contributed by the paternal or maternal parent. Moreover, in all the crosses observed by DAVIS, even where patroclinous and matroclinous tendencies were most conspicuous, the influence of both parents was plainly recognizable. He has "observed no certain evidence that a morphological character of either species in a cross is passed on to the F_1 hybrids exactly as it is represented in one or the other of the parents." This fact, DAVIS notes, would render untenable GOLDSCHMIDT's assumption of merogony, even though that explanation had not been made doubtful by the cytological data of RENNER. No satisfactory explanation of these results has been suggested.—R. A. EMERSON.

Transpiration in succulent plants.—DELF[14] has made an interesting study of the transpiration peculiarities of the different classes of succulent plants, having carried on a number of experiments and having endeavored to organize

[13] DAVIS, BRADLEY MOORE, Genetical studies on *Oenothera*, V. Zeitsch. Ind. Abst.- u. Vererbungslehre **12**:169–205. 1914.

[14] DELF, E. MARION, Transpiration in succulent plants. Ann. Botany **26**:409–442. 1912.