and the various mutants are plants which result when one or more of these groups are in a homozygous recessive condition. This might be represented graphically thus: *O. Lamarckiana* = *Aa Aa Aa aa; Bb Bb bb bb; Cc Cc cc cc,* etc., where in every group at least one of the factors would be present in the positive condition. A mutant = *aa aa aa aa; Bb Bb bb bb; Cc Cc cc cc,* etc., where in at least one of the groups none of the factors are present in the positive condition. This interpretation is thought to explain the occurrence of different ratios of mutation, for if there were 4 such independent multiple factors for the *Lamarckiana* character, a given mutant dependent upon the absence of all these positive factors would occur in the following percentage: 1.2 per cent when all of the 4 factors are heterozygous; 3.7 per cent when only 3 of the 4 factors are heterozygous; 11.1 per cent when only 2 of the 4 factors are heterozygous; 33.3 per cent when only 1 of the 4 factors is heterozygous.

At several points in his paper the author points out that since different strains of *O. Lamarckiana* yield different series of mutants it cannot be an elementary species, as DEVRIES claims, but must be a group of elementary species, the free intercrossing of which makes possible the production of the mutants by ordinary Mendelian segregations. The assumption of extensive linkage of characters, of the occurrence of heterogamy (that is, the transmission of hereditary characters through the sperms differing from those possessed by the eggs of the same individual), and the assumption that one sort of sperm may hinder the activities of another sort of sperm, are not in strict accord with the author's claim that he has given a Mendelian interpretation of *Oenothera* genetics.—BEN C. HELMICK.

Mutation in Matthiola annua, a "Mendelizing" species.—In a preliminary paper under the foregoing title FROST[2] has published certain conclusions in regard to the origin of Mendelian dominants which are sure to arouse no little interest. Until the full account appears it will be impossible to judge of the validity of FROST'S interpretation of his discoveries, but the discoveries themselves are obviously of prime importance, interpret them however we may. According to his own view, he has observed the origin by mutation of 8 different dominant Mendelian varieties from a single strain of stocks. To show that this would be a discovery of the highest theoretical significance, it is only needful to point out that similar evidence is extremely meager, and in practically every case not as well attested as one might wish. The list of new dominants which have arisen by mutation is practically exhausted when we have mentioned KEEBLE'S giant *Primula* and COLLINS' albinistic maize, for the case of GATES' *Oenothera rubricalyx* is still in dispute.

FROST states that the individual mutations of his *Matthiola* cultures obviously are not extracted recessives, but heterozygous dominants; that they seem to be due to definite changes in the germ plasm distinct from the recombi-

[2] FROST, HOWARD B., Mutation in *Matthiola annua*, a "Mendelizing" species. Amer. Jour. Bot. 3:377–383. 1916.

nations involved in ordinary Mendelian phenomena; that the mutative changes concern various characteristics of the plant, but that the factor for each new type is regularly inherited as a unit, sometimes showing linkage with another factor pair, so that we may suppose, in some cases at least, that the essential change is limited to a portion of one chromosome. The very first test of these conclusions would demand that the mutations reproduce the mutational type in 75 per cent of their progeny in the first generation, and that 25 per cent of the progeny be homozygous dominants. This condition apparently is satisfied in the case of only 1 mutation of the 8, and until the data appear we have no basis for an independent judgment as to whether the progenies of the second generation were large enough to prove the point at issue. Except from this one mutation, no homozygous mutational type has segregated from any of the supposed heterozygous dominants. In the mind of one who is familiar with the group of the evening primroses a suspicion naturally arises that FROST'S mutations are not Mendelian at all, but that they show the type of behavior familiar in *Oenothera lata* DeVries, and recently discovered in mutations from *O. stenomeres* and *O. pratincola*. These mutations always give progenies consisting of a mixture of the parental and mutational types. In the case of *O. lata* the cytological explanation is now so well known as hardly to require comment; it certainly suggests that a cytological examination of the *Matthiola* mutations would not be amiss. Reciprocal crosses between the mutational and parental types might also throw light on the possible analogy between the evening primroses and stocks, for in such types as *Oenothera lata* mutational characters are carried only by part of the female gametes, and by none of the male gametes. All that FROST tells about the *Matthiola* mutations so exactly parallels what is found in *Oenothera* that one can hardly refrain from suggesting, in the absence of data supporting his own interpretation, that instead of discovering new Mendelian dominants he has found in a widely distant group some of the perplexing phenomena which critics of the mutation theory persist in regarding as peculiar to *Oenothera*. More and more facts are coming to light in groups other than *Oenothera* which do not fall into line according to Mendelian expectations. As an example of what looks like mutation in the DeVriesian sense, one thinks of the rogues of peas, investigated by BATESON; as an example of matroclinic, non-segregating hybrids, quite comparable to those of *Oenothera*, we have the cases in *Primula*, recently reported by PELLEW and DURHAM. If the type of heredity shown by *Oenothera lata* were found to apply to the mutations of *Matthiola*, it would be almost as interesting as the discovery of new Mendelian dominants.—H. H. BARTLETT.

Respiration in succulents.—That succulent plants exhibit peculiarities in their respiratory processes and periodic changes in acidity with light and darkness has been known for a long time. RICHARDS[3] has investigated these

[3] RICHARDS, HERBERT M., Acidity and gas interchange in cacti. Carnegie Inst., Washington, Publication no. 209. pp. 107. 1915.