2. Preliminary genetic evidence that the $Adh_1^{FC^m}$ duplication produces a single transcript.

Schwartz (1973) has suggested that the $Adh_1^{FC^m}$ duplication (Schwartz and Endo, 1966) produces a single transcript. To investigate this possibility further, an ethyl methanesulfonate (EMS) mutagenesis study of the duplication was initiated. Seeds homozygous for the duplication were treated with .08 M EMS for ten hours at room temperature and then washed and dried by the method of Briggs, et al. (1965). The 4500 treated seeds were planted in the field and pollinated by one of three Adh_1 alleles: 1) the naturally occurring S allele, 2) a fully active EMS-derived mutant, W, specifying an enzyme which remains near the origin in pH 7.5 starch gel electrophoresis, and 3) an EMS-derived mutant of S that forms a reduced amount of monomers capable of dimerization. Mutant sectors were detected by electrophoretically testing ten kernels from each ear. Mutants in one or the other or both components of the duplication could be detected by a departure from the expected zymogram pattern. Of the 363 ears screened, fourteen had an electrophoretically detectable mutation involving one or both components of the duplication. Five classes of mutants were found.

Class 1: Change in the electrophoretic mobility of C^m; no change in F.

Two mutants were found in which the protomers specified by the C^m component were changed to faster migrating forms. A third mutant may involve a change in C^m producing protomers that migrate as F. This mutant was crossed by the low-dimerizing mutant of S and thus could also be interpreted as an elimination of the C^m subunit with the retention of the F. These two alternatives can be distinguished on the basis of activity ratios when the mutant is crossed by a fully active, fully dimerizing S allele.

If only F monomers are produced in the third mutant, the zymogram of scutellar extracts will show a 1 FF: 2 FS: 1 SS ratio of activity, when crossed to the normal, fully dimerizing S. If the C^m component were mutated so that the protomers produced migrate as F, then the activity ratio would be 2 FF: 3 FS: 1 SS, since the mutant C^m homodimer would migrate to the F position. The S plus mutant heterodimer would migrate to the FS position, and the F plus mutant heterodimer would migrate to the

FF position. This is the expected activity ratio, if there is random association within a population of 2 F: 1S monomers, with half of the F monomers being virtually inactive, as is the case with C^m.

Class 2: Change in the electrophoretic mobility of F; no change in C^m.

Two mutants were recovered in which the F component produced a form migrating to the position of the naturally occurring S.

Class 3: Elimination of the F subunit; no change in C^m.

Four mutants were found which produced homo- and heterodimer enzymes containing subunits specified only by the C^m component and the allele introduced by the pollen.

Class 4: Elimination of both the F and C^m subunits.

Four mutants were found in which only the isozyme specified by the allele introduced by the pollen parent was observed in the zymograms. These could be interpreted as a change in electrophoretic mobility of the protomers specified by one component of the duplication to that of the pollen allele and concomitant elimination of the other. However, it is more likely that these mutants represent a loss of both types of subunits specified by the FC^m duplication. This loss could be interpreted in two ways. First, the loss of both might be due to a deletion of the duplication. Secondly, a nonsense mutation in the first component could prevent the translation of the second component of the duplication as well. Since there is no unequivocal case of the elimination of the C^m subunit only, the latter is favored and the class four mutants are thought to represent mutations in the C^m component which block the translation of the remainder of the message, including the F segment. The various interpretations will be tested by checking the mutant homozygotes immunologically for cross-reacting material.

Class 5: Polarity type mutation.

One mutant was found in which only approximately 1/2 the normal number of monomers of C^m was produced and only 1/8 the normal number of F monomers was formed. The particular lesion in this mutant is a matter of speculation; yet it is clear that a single mutation has affected both components of the duplication.

In conclusion, the preliminary data indicate that the FC^m duplication produces a single message, which is translated in the direction of

$\underline{C}^m$ to $\underline{F}$. Additional mutants are being sought and a genetic and immunological analysis of those mutants described herein is underway.

References:

Schwartz, D. 1973. The $\underline{Adh}_1{}^{FC^m}$ "Operon". Maize Genetics Cooperation Newsletter 47: 53.

Schwartz, D. and Toru Endo. 1966. Alcohol dehydrogenase polymorphism in maize-simple and compound loci. Genetics 53: 709-715.

Briggs, R. W., Amano, E. and Smith, H. H. 1965. Genetic recombination with ethylmethanesulfonate induced waxy mutants in maize. Nature 207: 890.

James Birchler

3. Further studies on the cause of variation in the frequency of chromatin loss induced by B chromosomes.

In the 1972 Maize News Letter we reported different rates of chromatin loss induced by B chromosomes when two plants of the high-loss strain were used as the pollen parent in crosses with two different genetic lines. When plant 30785-24 with 7 B's, homozygous for the $\underline{A}_1$ allele and the 3L knob, was used as the pollen parent onto $\underline{d}\ \underline{lg}_2\ \underline{a}$ silks, 12.7% of the F_1 kernels had colorless aleurone. Pollen from the same plant gave 21.7% colorless kernels when crossed to $\underline{a}\ \underline{B}\ \underline{Pl}$ testers. A sibling plant 30785-23 with 8 B's yielded 8.9% colorless seeds when its pollen was placed on $\underline{d}\ \underline{lg}\ \underline{a}$ silks and 19.5% colorless kernels on the $\underline{a}\ \underline{B}\ \underline{Pl}$ tester. These data are explicable if in the $\underline{d}\ \underline{lg}_2\ \underline{a}$ crosses there is preferential fertilization of the egg by the deficient sperm, while in the $\underline{a}\ \underline{B}\ \underline{Pl}$ crosses the deficient sperm preferentially unites with the polar nuclei to form the endosperm. Preferential fertilization, however, proved to be not responsible for the dissimilar rates since for both pollen parents, the high rate of endosperm loss in the $\underline{a}\ \underline{B}\ \underline{Pl}$ crosses was not associated with low embryo loss; there was no compensating increase in embryo loss if endosperm loss was low and vice versa.

Two alternative explanations were considered. One of these ascribed the dissimilar rates of loss to environmental differences of an unknown nature. Circumstantial evidence in support of this hypothesis is the fact that for both plants 23 and 24 the pollen used in crosses with