6. Resemblance of maize-teosinte mutants to those occurring in long-inbred strains.

It now appears probable that many, if not the majority, of mutations occurring in long-inbred strains of maize are the result of some phenomenon involving blocks of teosinte genes. There is little doubt that the majority of maize varieties of Central America, Mexico, and the United States have at some time in their history undergone teosinte introgression or that the majority of inbred strains derived from these contain some teosinte genes. Strains such as Oh28, for example, have cobs as highly lignified as some of our maize-teosinte derivatives in which teosinte chromosomes have been introduced.

The mutants reported by Singleton are particularly interesting in this connection. When the mutant dwarf which he found in an inbred line of sweet corn was crossed with another inbred new variations such as germless seeds, brittle seeds, and virescent seedlings were observed. This situation is similar to that reported above where one mutation was followed by a series of others. Also all of these mutations reported by Singleton have occurred in our maize-teosinte derivatives, as have also the narrow leaf, male-sterile dwarfs, and small seeds reported by Schuler.

The transposition of a block of genes from one chromosome to another could produce heterozygosity in long-inbred, apparently homozygous strains and this process could account for the residual heterozygosity which Schuler found in several inbred mutants.

If the majority of mutants in long-inbred strains are the product of transposition of blocks of genes, they are of doubtful value in experiments designed to measure the heterosis resulting from heterozygosity at a single locus.

7. Possible relationship of maize-teosinte mutants to previously described mutation systems.

We have long suspected that the mutation systems described by McClintock and by Brink owe their origin to teosinte genes introduced into maize chromosomes. It has not yet been possible to prove this but it is significant that the controlled introgression of teosinte into maize produces mutability; that some of the mutants are unstable and involve a number of "states"; that defective seeds are common; that disturbance of Mendelian ratios often occurs; and that there appears to be "transposition" in both kinds of systems.

The maize-teosinte derivatives do not, as such, appear to carry the Ac factor of the McClintock system but they may in some manner give rise to it. In 1954 five different maize-teosinte derivatives produced 1.4, 1.2, 1.2, 0.7, and 2.0 percent of mosaic seeds involving the c locus when crossed with the Ac tester. Another derivative, one which

had previously mutated to defective seeds and which, following outcrossing, gave rise to other mutants, had 18.1 percent of mosaic seeds when crossed with the Ac tester. Several generations of selection have increased this percentage to 100. The stock now resembles some of McClintock's supresser-mutator stocks.

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8. The characteristics of Huixta, Durango, and Nobogame teosinte chromosomes.

Since the summer of 1956 three teosinte varieties, Huixta from northern Guatemala, Durango and Nobogame from northern Mexico, have been studied cytologically in F_1 hybrids with an inbred strain of maize, Wilbur's flint. This strain of maize is characterized by practically knobless chromosomes and by imparting good spreading quality to pachytene chromosomes. Whenever it was possible, an inbred maize strain, Conn. P39, was also used in crosses in order to confirm the findings. Both of these strains of maize were previously studied in many crosses and no chromosome inversions or any other rearrangement were observed. Cytological observations on these teosinte varieties are as follows:

Huixta teosinte showed no inversions in hybrids with maize. It differs from other Guatemalan teosintes previously studied in having the majority of its knobs located internally. Of 585 F_1 microsporocytes examined at diakinesis, 12.3 percent had two univalents, 0.8 percent, four univalents.

The F_1 hybrids of maize and Durango teosinte were heterozygous for two inversions. Since the maize strain employed in the cross did not have any chromosome inversions, the inversions must have been introduced by the teosinte parent. These inversions are located on the short arms of chromosome 8 and 9 and are practically terminal. They represent 59 and 56 percent respectively of the short arms of these chromosomes (Tables 1 and 2). In the microsporocytes of these F_1 hybrids dicentric bridges and acentric fragments were found at both anaphase 1 and anaphase 2. At diakinesis, 0.8 percent of the microsporocytes had two univalents, but microsporocytes having more than two univalents were not observed among 514 cells studied.

Two previously unreported knob positions were found in Durango teosinte; one on the long arm of chromosome 8, the other on the long arm of chromosome 9.

The F_1 hybrids of maize and Nobogame teosinte were heterozygous for three inversions contributed by the teosinte parent. Two of these inversions are practically terminal. One is on the short arm of chromosome 8, the other previously reported (MNL 1957) on the short arm of chromosome 9. The In 8 represents 62 percent of the short arm; while the In 9 represents 59 percent of the short arm (Tables 3 and 4).