It seems that abnormal 10 has the capacity of increasing the recombination frequency between the two loci studied. The Wd and Wx ratios obtained were found to be significant deviations from a 1:1 ratio. Since 59% Wd is statistically different from 51% Wd, and also 51.9% Wx from 50.6% Wx, the 4.8% difference between the two mean recombination frequencies could be statistically a significant one. Analyses ("t" test) have shown that the two means are different, although the difference is a small one.

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1. The enhancer factor--a fourth location.

In a previous Maize News Letter (1953) it was reported that Enhancer, (En), the dominant mutator that causes pg^m-mutable pale green- to mutate to Pg-green - can be variously located. (Without En, pg is stable). It has been found (1) adjacent to pg (the autonomous mutable condition), (2) on the same chromosome and 36 units from pg, and (3) on an independent chromosome. En has recently been found at a 4th location, on another independently assorting chromosome. This new location appeared among some F_2 progenies of a series of crosses of a non-segregating En stock (Pg/Pg En/En) by pg^s (stable pale green). Ordinarily, the self of this F_1 (Pg/pg En/+) yields an F_2 with pale green seedlings segregating 3 pg^m : 1 pg^s. This ratio indicates that En is segregating (pg with En is mutable and pg without En is stable). In one particular series of crosses, 2 or the 10 segregating progenies gave only 6% pg^s among the pg class which is significantly lower than the expected frequency of stables (25%). The expected genotype of the parents, F_1 and the segregation of these exceptional F_2 progenies are as follows:

Pg/pg +/+ x Pg/Pg En/En —— F_1 Pg/pg En/+ (green)

Exceptional F_2 progenies			% pg^s
1956	443-10 ⊗	135 + : 35 pg (2 pg^s : 33 pg^m)	5.7%
1956	443-13 ⊗	145 + : 49 pg (3 pg^s : 46 pg^m)	6.1%

These results suggest that En must be in a heterozygous condition at two separate loci, each locus independent of pg. The F_1 of the above cross would then be Pg/pg En/+ En/+. Of the resulting F_2 progeny, only 1/16 of the pg genotypes would lack En. These would therefore be stable: chromosome linkage of En has not yet been established for either of the two independent locations.

This second independent location of En originated in the En stock which has been propagated since 1952.

2. a_1 mutable

In previous Maize News Letters (1953, 1956) it was reported that a new a_1 mutable (a_1^m) appeared in a culture of mutable pale green (pg^m). This mutable allele mutates from a_1 to A_1 (colorless to full color) and is characterized in the kernel by dots of dark anthocyanin pigment on a non-pigmented colorless background.

At least seven distinct patterns are recognizable: these range from kernels with a small dot pattern to other kernels with large areas of anthocyanin pigmentation. These patterns depend on the frequency and time of mutation events. Individual patterns are heritable as definite properties of the individual a_1^m allele and are not a result of segregating modifiers. This is evident from the results of continued outcrosses. In each case the parental pattern is recovered in all of the progeny except a few ($\pm$ 1%) which possess new patterns that are in turn distinct and heritable. Such results indicate that control of the pattern is intrinsic to the mutable allele itself. Outcross tests show also that the control of mutability resides at the a_1 locus indicating that mutability is autonomously controlled.

Mutation to the colorless stable form: the most conspicuous change in the different patterns of a_1^m is the change to a stable, non-pigmented form, a_1^s. The rate of change to a_1^s varies in frequency, but in general the earlier occurring patterns mutate to a_1^s at a higher rate ($\pm$ 6%) in testcrosses than do the finer dot-like patterns (1-2%). Thus, the different patterns can also be identified by their rate of mutability to the stable form.

A separable mutator: In several testcrosses ($a^m Sh/a^{dt} sh$ x $a^{dt} sh/a^{dt} sh$) of an a^m allele with a fine mutable pattern, half of the non-shrunken kernels were stable and half were mutable. The shrunken kernels were completely colorless. Such a result indicates that a mutator is segregating and when present causes the a_1^m allele to mutate. Half of the shrunken kernels should therefore contain the factor. Crosses were made between plants of stables and numerous sib shrunken kernels. In half of the crosses, half of the non-shrunken kernels on the ear were mutable. This verifies the presence of a separable factor controlling mutability. This independent controller of mutability arose from the autonomous type. The recovery of this independent controller of mutability is similar to the recovery of independent En in pg stocks containing the autonomous type of mutability control.

The colorless kernels that become mutable in the presence of the above described controller of mutability are unaffected by Dt or Ac. Similarly, a^{dt} and Ds-controlled loci do not mutate in the presence of