2. Further study of Ac control of mutation at the bronze locus in chromosome 9.

In last year's News Letter, a case was described of control by Ac of gene action at the bronze locus in chromosome 9. This case has been further examined and evidence was obtained suggesting a relationship between an apparent direct Ac control of gene action and indirect control of this action, such as that exhibited by the Ds - Ac two element system where the Ds element directly controls types of modification in gene action but does so through the influence that Ac exerts on it. As mentioned last year, the recessive bz in this case was capable of mutating to higher alleles of Bz as well as to stable recessives, and control of this process was found to be associated with the presence of Ac at the locus. The relatively simple types of change in gene action are those that give rise to stable dominants or to stable recessives. Altogether, 14 independent mutations to a stable dominant were examined. In all 14 cases, mutation to Bz was associated with removal of Ac from the bronze locus. In 6 cases, it was not present in the gamete that carried the Bz mutant. In the remaining 8 cases, Ac was present in the gamete but its location was altered. In 4 of these 8 cases, the Ac element showed no linkage with markers in the short arm of chromosome 9. In the 4 other cases, Ac was linked to these markers. In 3 of them, it was located several crossover units to the right of Bz and in one case it was located very close to Wx.

Twenty-four cases of mutation to a stable recessive were examined. In 9 of these cases, Ac was absent in the gamete that carried the stable recessive. In 5 cases, one Ac was present but it showed no linkage with markers in the short arm of chromosome 9. In 9 cases, one Ac was present and it showed linkage with markers in the short arm of chromosome 9. In 2 of these 9 cases, Ac was located close to Wx, and in one case, it was located very close to sh. In the remaining 6 of these 9 cases, its exact location was not determined; it was linked with Wx and showed from 20 to 30% recombination with it. In the remaining case, two Ac elements were present, one located close to but to the right of bz, the other showing no linkage with markers in the short arm of chromosome 9.

Two cases were found in which control of mutation at bz had changed from apparent direct Ac control to indirect control by this element. In all essential respects, the system of control of mutation in these two cases is the same as that exhibited by the Ds - Ac two element system. Ac is not present at the locus of bz but its presence in the chromosome complement is necessary for mutations to occur there, and the time of their occurrence reflects the Ac dose in the cells.

In addition to the mutant types mentioned above, two cases of mutation to an unstable dominant, Bz, were examined. In both of them, Ac was present and located at or close to Bz. Examination of a number of derivatives of one of them was made and the types of modification found are listed below:

1. Change to a stable dominant associated with removal of Ac from the Bz locus, apparently a frequent occurrence but only 3 cases examined in detail.

2. Change to a mutable recessive, bz. 8 cases examined. All had Ac at the bz locus. Mutations controlled by Ac. Marked change in Ac dose action was exhibited by 4 of these cases.

3. A change in state of the Bz locus recognized by a very high rate of mutation from Bz to bz. Ac present at or close to the Bz locus and the mutation process controlled by it.

4. Appearance of a high rate of Ds-type chromosome breaks at a position a few crossover units to the right of Bz. The Bz phenotype is stable. Ac occupies the locus where the Ds-type breaks are occurring. Twelve derivatives of this particular modification that showed no breaks or a reduced frequency of them were examined. In 2 cases, Ac was not present in the plant. In 6 cases, the location of Ac was apparently unchanged but Ds-type breaks were very much reduced in frequency or did not occur. In the remaining 4 cases, 2 Ac elements were present, one at or close to the former location and one located elsewhere (the second Ac element was close to wx in two cases and not linked to markers in the short arm of chromosome 9 in one case.).

5. Appearance of an intermediate allele giving a weak Bz expression. Ac no longer present at the locus. However, if Ac is present somewhere in the chromosome complement, mutations occur at this locus to give alleles expressing higher or lower levels of the Bz phenotype. This intermediate allele is stable in the absence of Ac.

6. Mutability of a component of the Bz locus detected in kernels that are C sh bz wx ds/C sh bz wx ds/I Sh BzAc Wx Ds in constitution. Breaks at Ds in the I Sh BzAc Wx Ds chromosome during development of the endosperm produce areas that are C sh bz wx in phenotype. When the normal Bz locus is present, such areas have rims showing the Bz phenotype due to diffusion of a substance produced in the surrounding I Sh Bz Wx cells in response to the presence in them of Bz. In the case here considered, only short, interrupted streaks of the Bz phenotype appear in the boundary rims of the C sh bz wx areas. In kernels that are I Sh BzAc Wx Ds/I Sh BzAc Wx Ds/C sh bz wx ds in constitution the majority of C sh bz wx areas show either no Bz streaks in the rim cells or only an occasional very small streak. However, in kernels that are C BzAc/C bz/C bz in constitution and in the plants derived from them, full Bz color appears. This suggests a possible dual activity of the genic materials at the Bz locus and, in this case, mutability is being expressed by only one of these components.