2. Progressive conversion of R-locus expression through eight generations.

The demonstration of progressive reduction of endosperm pigment conditioned by the R locus raises the question of whether the end-point of such treatment can be detected short of the recessive, completely colorless phenotype or whether extended treatments over many generations--more than ten--will give R phenotypes indistinguishable from those conditioned by r. Typical testcrosses where the R alleles from the RR^{st} heterozygotes are scored in one dose give colorless or very nearly colorless phenotypes after three or four generations with R^{st}. Yet when these same R^3 or R^4 alleles (three or four generations with R^{st}) are brought into aleurone tissue through the female for two dose expressions ($R^4R^4r^g$, for example) or if R^4R^4 homozygotes are selfed ($R^4R^4R^4$ endosperm), self color phenotypes are common and considerable pigment can still be found on most kernels of the ear.

To continue observations on the ability of these progressively treated R alleles to produce pigment, aleurone color is scored where the treated R genes are brought through the female only or both through the male and female. RR homozygotes extracted after treatment for a varying number of generations with R^{st}, were selfed for three dose aleurone pigment. RR^{st} plants were pollinated with r^gr^g to give the two dose aleurone (RRr^g). The alleles in question were carried in inbred W22 background. Ear mean scores are based on samples of 50 kernels from each ear. Each kernel was scored against a set of standard kernels represented by 0 (zero), the colorless class, through 22, the fully pigmented class.

Table 1 shows the scores of RR homozygotes which have been selfed. The data show a steady progression toward the colorless phenotype with an average reduction of half a class interval per generation. The same results can be observed in Table 2 where the R alleles are given as two dose expressions since R is removed directly from the RR^{st} heterozygote. In Table 2 the treatment is carried to the eighth generation. Sampling errors account for some of the year to year unevenness in reduction of pigment, nevertheless, the trend over the seven and eight generations is clear.

Table 1
Pigment Scores for Aleurone with Three R Alleles After R Has Been Heterozygous with R^{st} from One to Seven Generations

	R^{1*}	R^2	R^3	R^4	R^5	R^6	R^7
Pooled $\bar{X}$ (6 ears/ treatment)	21.96	21.65	20.55	19.58	19.48	18.97	18.65

*Superscripts represent number of generations R has been heterozygous with R^{st}.

Table 2
Pigment Scores for Aleurone with Two R Alleles Present Where R Has Been Heterozygous with R^{st} for One to Eight Generations

	R^1	R^2	R^3	R^4	R^5	R^6	R^7	R^8
Pooled $\bar{X}$ (6 ears/ treatment)	21.92	21.71	21.21	20.28	19.67	20.00	19.48	18.76

The mechanism of R pigment control still remains to be discovered. Since the extreme phenotypes cannot be selected for, it appears that it is the penetrance conditions which are being progressively altered from one generation to the next as R is maintained with R^{st}. This progressive penetrance control of R expression provides an interesting genetic phenomenon with "memory" capabilities. The endosperm pigment system cannot only be manipulated in a directed way—i.e. taught to respond--but its "I.Q." can be tested by means of the "read-out" supplied by the endosperm pigmentation. Thus the pooled ear means constitute gene-treatment histories reaching back as far as eight generations, recalled now and summarized as a single figure.

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3. Light controlled diurnal rhythm in corn seedlings.

Germinating seeds were found to show diurnal responses in water uptake beginning 24 hours after initial contact with water. Seeds of inbreds W22 x W23 were placed in shallow, glass-covered germinating pans and maintained eight days under the controlled light and temperature conditions of two growth chambers. Seeds were germinated during this period on pads of germinating paper soaked with distilled water. One chamber environment was maintained on alternating 12 hour light and 12 hour dark cycles; the other chamber had constant light conditions. A chamber light intensity of approximately 1700 foot candles was diffused through a white cloth placed over the glass-covered pans; ambient temperature within the chamber was 22.5° C. From the start of germination, 20 seeds were weighed each 12 hour period (at the beginning and end of each dark cycle).

Tables 1 and 2 show the typical rhythmic patterns. Those seeds grown on the 12:12 cycle (LD) show a clear rhythm beginning after the first 24 hours of germination. This rhythm continues for the next three days. The seeds were then transferred to constant light conditions (LL). After transfer to LL conditions, the rhythm is damped and the rate of weight gain is reduced with the loss of the rhythm. It may also be noted that under the LD conditions it is during the dark period that most activity is taking place.

Where seeds were started under LL conditions there is no apparent rhythm in water uptake. After four days under LL the seeds were transferred to LD conditions where a pronounced rhythm becomes observable and a marked