1. Shrunken-floury, a gene affecting protein synthesis.

Circumstantial evidence is available which shows that a recessive gene sh^{fl} may have an effect on protein metabolism. The following phenotypic effects are exhibited by this allele:

(1) Shrunken-floury kernels. The horny endosperm layer is reduced or entirely missing so that only the floury or starchy endosperm remains, producing a smaller and lighter kernel whose surface is shrunken and convoluted.

(2) Stunted plants. These plants are strikingly smaller than their normal sibs.

(3) Aleurone layer abnormalities. The aleurone pigmentation is not uniform giving a speckled or mosaic pattern. Microscopically many of the aleurone grains are not pigmented but appear as "aleurone ghosts". Large globules, probably fat droplets, are seen in shrunken-floury aleurone tissue but never in normal aleurone.

(4) Aberrant meiotic mechanism. In most sh^{fl} families a varying degree of pollen and ovule sterility has been noted. (4-35 percent aborted pollen is found, the most frequent value being around 14 percent abortion.) Examination of sporocytes of shrunken-floury plants reveals striking meiotic abnormalities in some plants. These include:

(a) Anaphase I: There is no normal anaphase movement. Apparently the chromosomal fibers are not functioning and spindle formation is seemingly absent. The appearance of some distended chromosomal arms suggests the formation of neocentromeres.

(b) Telophase I: This stage is absent since the chromosomes do not move to the poles. No cell wall formation occurs.

(c) Metaphase II: Twenty dyads line up on the metaphase plate.

(d) Anaphase II: The two chromatids of each dyad do not pass to opposite poles but separate slightly when the centromere divides.

(e) Telophase II: Again there is no cytokinesis. Instead of quartets only one large call with 40 chromosomes is produced. These 40 cells give rise to aborted pollen grains.

Since horny endosperm differs from floury endosperm largely by the amount of protein, since aleurone grains, spindle and chromosomal fibers are proteinaceous, and since the sh^{fl} gene produces abnormalities in these areas, it seemed possible that the sh^{fl} gene is concerned with protein synthesis.

In an attempt to get some quantitative data to support this circumstantial evidence, Kjeldahl determinations for total nitrogen were run on different genotypes from the same ear. The results which follow are average values for three ears:

Genotype	Average kernel weight	percent nitrogen
Sh_2__Sh^{fl}	.200 gm.	2.24
$sh_2sh_2Sh^{fl}$	.123 gm.	2.75
Sh_2__$sh^{fl}sh^{fl}$	.127 gm.	2.18
$sh_2sh_2sh^{fl}sh^{fl}$	.052 gm.	2.69

These data show that the per cent nitrogen is probably not affected by the recessive sh^{fl} gene. (The increase in the nitrogen percentage for the sh_2 gene, however, is significant and its effect is what might be expected for a gene blocking the carbohydrate pathway.)

Although there are indications that protein synthesis is affected by sh^{fl} it produces no effects on total nitrogen. Thus the sh^{fl} gene may act at a relatively late stage in protein metabolism so that the high molecular weight proteins are not produced, yet the per cent nitrogen is unaffected.

The sh^{fl} gene has been located on chromosome 5 near the pr locus; preliminary results indicate a distance of about 15 cross-over units. Linkage data from three-point tests are not yet available. Two modifiers, one dominant and one recessive, have been found which increase the weight of the $sh^{fl}sh^{fl}$ kernels.

Dewayne L. Richardson