Note: Upper and lower entries in right triangle cells are sums of squares for $\frac{n^2}{2}D$ between and for D within, respectively $X10^3$. The cells in the left triangle show the variance ratios. (For $n_1 = 50$ and $n_2 = 50$ a variance ratio of 1.94 is significant at the 0.01 level, and a ratio of 1.60 is significant at the 0.05 level).

Glassman, E. and E. C. Keller, Jr. University of North Carolina. The maternal effect of ma-1^+: The effect of hypoxanthine; the effect of lxd.

The maroon-like (ma-1) eye color mutant lacks detectable amounts of xanthine dehydrogenase, pyridoxal oxidase (pyridoxal- pyridoxic acid), and the ma-1^+ complementation factor. When ma-1 flies are derived from female parents that carry an ma-1^+ gene, their eye colors are wild-type and xanthine dehydrogenase activity can be detected, especially in early development (Glassman and Mitchell, Genetics 44:547, 1959; Glassman and McLean, Proc. Nat. Acad. Sci. 48: 1712, 1962).

The maternally-affected eye color is observed only in adults that emerge in the early days of hatching. Those that emerge in older bottles have the usual mutant ma-1 eye color. This loss of the maternal effect is not due to the age of the mothers, and must be ascribed to changes in the food (Glassman and Mitchell, loc. cit.). Either a substance is being used up or an inhibitor is accumulating. We believe that the latter explanation is true, and that the purines which accumulate in the food are inhibiting the low amounts of xanthine dehydrogenase in the maternally-affected ma-1 flies so that little pterdine eye pigment is synthesized.

To test this we crossed y f:=; st females to m ma-1; st males and allowed eggs to be laid on three different media: a) the usual Drosophila medium (devised by E. Lewis), b) the usual medium containing 0.1% hypoxanthine, and c) the usual medium containing 0.1% uric acid.

In these experiments the maternal effect did not diminish on the control medium until 10 and 12 days (replicate experiments) had elapsed. On the other media, the maternal effect diminished by 2 and 4 days (replicate hypoxanthine experiments) and by 7 and 9 days (replicate uric acid experiments). Thus, hypoxanthine (and perhaps uric acid) accelerates the disappearance of the maternal effect. Whether these compounds accumulate to a sufficient extent in the food to account for the loss regularly observed, and whether the mechanism is through inhibition of the small amounts of xanthine dehydrogenase remains to be shown.

The mutant, lxd, lacks the ma-1^+ complementation activity as well as the pyridoxal oxidase activity. Since these are also lacking in ma-1, we tested the effect of lxd on the maternal effect as follows:

A. The cross y f:=; ru lxd by females x v f Bx^3 ma-1 males produced v f Bx^3 ma-1; ru lxd by/+ males all of whom (94 in the first three days) were maternally affected. Thus, homozygous lxd in the mother has no influence on the maternal effect in the progeny.

B. The cross, v f Bx^3 ma-1; ru lxd by/TSS x ru lxd by/D, produces three types of males which were classified and counted during the first three days of emergence. These were:

genotype	phenotype (number maternally affected)
v f Bx^3 ma-1; ru lxd by	Only 1 out of 41
v f Bx^3 ma-1; ru lxd by/TSS (or D)	56 out of 56
v f Bx^3 ma-1; TSS/D	22 out of 22

Thus, homozygous lxd in the progeny completely abolishes the maternal effect.

We interpret these results as follows: The maternal substance responsible for the maternal effect is the product only of the ma-1^+ locus. The lxd locus is not involved and thus lxd mothers can have progeny that are maternally affected. This is also true for the ry locus (Glassman and Mitchell, loc. cit.). However, for the maternal effect to be expressed in the progeny, enough product of the lxd^+ locus must be available for production of sufficient xanthine dehydrogenase for eye color synthesis to proceed normally. If lxd is in the progeny, then the maternal effect is abolished.

This interpretation is in accord with the idea that the lxd^+, ry^+, and ma-1^+ loci code for polypeptides (L, R, and M, respectively) that polymerize with each other. In this scheme, the maternal substance is, or is composed of, only the M subunit; the ma-1^+ complementation factor and the pyridoxal oxidase (these may be identical) are composed of M and L subunits;

while xanthine dehydrogenase is composed of M, L, and R subunits. The proof of this theory must await purification of these substances, although finding electrophoretic variants of xanthine dehydrogenase associated with each locus would indicate that all three are structural genes for this enzyme. We are currently analyzing three electrophoretic variants which we have found.

The idea that the ma-1^+ maternal substance is a stable template would also explain the effect of lxd on the maternal effect. This possibility is also being tested by analyzing the amount of the ma-1^+ complementation factor during the development of maternally affected flies.

Mittler, S. Northern Illinois University. AET and radiation induced crossing-over in male D. melanogaster.

A re-examination of the problem (Mittler and Hampel DIS 38) of whether AET has any effect upon radiation induced crossing-over in male D. melanogaster indicates that AET does afford significant protection to 9-12 day brood after irradiation. Adult males 2-16 hr. old heterozygous for ru h th st cu sr e^s ca were injected with 1 X 10^{-7}1. of 30 mg. AET/10ml buffered to pH of 7 and irradiated with 2000r and then back crossed to homozygous "rucuca" females at ratio of 1 male to 3 females. The males were transferred to new group of females every 3 days.

Number Males	9-12 day brood			12-15 day brood		
	Crossover	Non	% Crossover	Crossover	Non	% Crossover
120 Treated	57	8,502	.666	54	11,361	.473
101 Control	49	5,025	.966	29	4,187	.688

Glassman, E. University of North Carolina. Interaction of ma-l and lxd in the synthesis of pyridoxal oxidase and xanthine dehydrogenase.

The maroon-like (ma-l) and rosy (ry) eye color mutants lack detectable amounts of xanthine dehydrogenase. A strain which is mutant at a third locus (lxd) has only 20 to 25% normal amounts of this enzyme. Analysis of lxd flies reveals that the level of CRM (the suspected product of the ry$^+$ locus) is the same in lxd as in wild type, while pyridoxal oxidase (the suspected product of the ma-1^+ locus) is absent in lxd. Complementation tests in vitro are in agreement with these findings; thus there is no ma-1^+ complementation factor in extracts of lxd ry flies while the ry$^+$ complementation factor seems to be present in normal amounts in ma-l; lxd.

It seems evident that lxd is deficient in those molecules which are also specifically deficient in ma-l (such as pyridoxal oxidase and the ma-1^+ complementation factor) while the molecules missing in ry (such as CRM) seem to be present in normal amounts in lxd. Thus, the normal production of the ma-1^+ complementation factor and pyridoxal oxidase must be due to the interactions of the lxd$^+$ and the ma-1^+ loci. The paradox of the presence of substantial, though less than normal, amounts of xanthine dehydrogenase in lxd in spite of the absence of the product of the ma-1^+ locus can be resolved by various hypotheses. One can postulate that the ry$^+$, the ma-1^+, and the lxd$^+$ loci code for three different polypeptide chains, designated R, M, and L, respectively. These polypeptides produce different enzyme activities by polymerizing with each other in different ways. Thus, a polymer of the M and L polypeptides will have pyridoxal oxidase activity, while any polymer containing R polypeptides will have CRM activity. Only a polymer containing R, M, and L polypeptides will have xanthine dehydrogenase activity. On this basis, the in vitro complementation reaction between ma-l and ry extracts would be visualized as an interaction between two large polymers containing ML and R subunits, respectively. The deficiencies observed in lxd flies would be due to a defective L polypeptide which can still react in vivo to yield some xanthine dehydrogenase activity, but which is too defective to yield active ML polymers (pyridoxal oxidase). It is of interest that pyridoxal oxidase has a molecular weight almost as great as that of xanthine dehydrogenase (about 250,000).