Evans, W.H. Western Washington State College, Bellingham, Washington. Preliminary studies on frequency of autosomal nondisjunction in females of D. melanogaster.

As noted by Chadov (1969) aneuploid eggs may be fertilized by complementary sperm from isochromosome-bearing males. By this method he was able to demonstrate the non-homologous pairing of the X and Y chromosomes with the second chromosomes of XXY;Sm1, Cy/+ females. However, quantitative statements about the rates of primary and secondary nondisjunction of the major autosomes have not been possible to date because of the difficulty of recovering all progeny from the virtually sterile matings and because the behavior of isochromosomes in the male parents has not been well-defined.

Table 1 presents the results of an experiment designed to indicate the extent to which the presence of a Y chromosome and/or inversion heterozygosity causes nondisjunction of the major autosomes in D. melanogaster females. Three-to-five day old females of the various genotypes were mated to an excess of attached-3 males. Eggs were collected on charcoal-blackened standard medium by a method modified after Hildreth and Brunt (1961, D.I.S. 36: 128). After counting, eggs developed in a moist chamber at 25°C for 28 hrs. before flat eggs were tallied.

Table I

Hatchability of eggs laid by females of various genotypes after mating to C(3)L, ri;C(3)R, sr males. Second chromosome rearrangement is Sm1, Cy. Third chromosome inversion is In(3LR)CxD.

Maternal genotype	% Hatchability by attached-3 ♂♂*	% Hatchability by w/Y;+/+;+/+ ♂♂	Progeny type
1. XX;+/+;+/+	3.8	93	adult progeny rare, larvae die soon after hatching
2. XX;Cy/+;+/+	4.8	70	intersexes
3. XX;+/+;D/+	5.4	84	matroclinous and patroclinous-3
4. XX;Cy/+;D/+	4.3	61	same as above, also intersexes
5. $XXB^{S}Y$;+/+;+/+	6.1	91	same as 1 above
6. $XXB^{S}Y$;Cy/+;+/+	6.6	59	intersexes
7. $XXB^{S}Y$;+/+;D/+	10.1	65	same as 3 above
8. $XXB^{S}Y$;Cy/+;D/+	9.2	53	see Table II

* Data based on counts of 658-893 eggs.

From Table I it is clear that the hatchability of eggs laid by wild-type females mated to C(3)L, ri;C(3)R, sr males is unexpectedly high. This 3.8% hatchability reflects a toleration for aneuploidy that does not normally extend beyond the first instar. Assuming no major autosome nondisjunction in wild-type females, one would expect that this 3.8% hatchability is the lowest figure that would be obtained in any of the experimental matings to C(3)L, ri;C(3)R, sr males. Assuming further that these attached-3 males produce four sperm types (C(3)L, C(3)R, C(3)L;C(3)R, and nullo-3) in equal numbers (D.L. Lindsley and E.H. Grell, 1969) any hatchability in excess of 3.8% should represent 1/4 of the total diplo-and nullo-3 eggs laid. On this basis estimates of the frequency of third chromosome nondisjunction in the XX females could be made. Estimates of 2^{nd} chromosome nondisjunction due to the presence of Sm1 in the female genome are complicated by the fact that only 1/16 of aneuploid-2 eggs are recoverable in crosses to attached-3 (ri, sr) males. Only the diplo-2 eggs are recoverable, and these only by X-bearing C(3)L;C(3)R sperm, resulting in X/X;Sm1, Cy/+/+;C(3)L/C(3)R/+ intersexes.

Nevertheless, the data in Table I do seem to reliably reflect the number of aneuploid eggs laid by the various experimental females. Thus, the introduction of Sm1 causes an increase in hatchability and adult intersexes are recovered (lines 2 and 5). In the case of XX females which are inversion heterozygous for both major autosome pairs, the reduction in hatchability is presumed due to non-homologous associations of the major autosomes (Forbes, 1962). In the case of similar XXY females the reduction in hatchability is probably due to competition of the major autosomes in pairing with the Y chromosome. The data in the "progeny type" column of Table I are derived from mass matings paralleling the egg count matings.

Table II details the progeny types recovered from the cross XXB^{S}Y;SM1, Cy/+;Cx, D/+♀♀ x C(3)L, ri;C(3)R, Sr♂♂. The number of progeny is remarkable considering the small scale of the experiment. It is noted that the maternal Y is virtually always recovered in patroclinous-3 progeny indicating frequent Y-3 associations. Also, there seems to be a pronounced discrepancy in the recovery of such progeny.

Table II

Progeny from the cross XXB^{S}Y;SM1, Cy/+;In(3LR)CxD/+♀♀ x C(3)L, ri;C(3)R, sr♂♂

Patroclinous-3				Matroclinous-3				Intersexes	
genotype	♂♂	♀♀	total	genotype	♂♂	♀♀	total	genotype	total
B^{S}Y;+/+;(ri, sr)	3	8	11	+/+D/+	8	26	34	+/+/+;C(3)L/C(3)R/+	1
B^{S}Y;Cy/+;(ri, sr)	8	6	14	Cy/+D/+	7	14	21	Cy/+/+;C(3)L/C(3)R/+	8
+/+;(ri, sr)	1	1	2	B^{S}Y+/+D/+	1	1	2		
		total	27			total	57	total	9

In the course of this study it was noted that adult progeny are more readily recovered from matings of SM1/+ females to attached-3 males than from a mating of such females to attached-2 (b, cn) males. It would seem that aneuploid-2 eggs would be best recovered by complementary sperm from C(2)L, b;C(2)R, cn males. As mentioned previously only 1/16 of aneuploid-2 eggs are recoverable in matings to attached-3 (ri, sr) males. This result led to the conclusion that meiosis in C(2)L, b;C(2)R, cn males is not entirely random in regard to segregation of isochromosomes. This is further indicated in that 41% of the eggs laid by these attached-2 females develop into adults. In contrast the figure for the C(3)L, ri;C(3)R, sr stock is 19%. This figure agrees fairly well with a theoretical maximum of 25% if meiosis in females is regular and if segregation of the isochromosomes in males is random.

References: Chadov, B.F., 1969 Non-homologous pairing and non-disjunction of the second chromosomes in oogenesis of Drosophila melanogaster. Genetica 5:190-192; Forbes, C., 1962 The effect of heterozygous inversions on primary non-disjunction in Drosophila melanogaster. Genetics 47: 1301-1311; Lindsley, D.L. and E.H. Grell, 1969 Spermiogenesis without chromosomes in Drosophila melanogaster. Genetics Suppl. 61:1, 70-78.

Dapples, C.C. Rocky Mountain College, Billings, Montana. Ovarian morphology of the singed^{36a} mutant of D. melanogaster.

In this study feulgen-stained whole mounts of ovaries from females homozygous for the singed^{36a} mutation were compared with Oregon-R wild type ovaries of identical age. The singed^{36a} ovary is about half the size of the Oregon-R wild type ovary. The reduced size is due in part to the lack of oocytes in vitellogenic stages. There are also fewer chambers per ovariole and fewer ovarioles per ovary than in wild type ovaries. In wild type there are an average of a little over six egg chambers per ovariole and this number remains constant over the ten day period studied (0-10 days). In singed^{36a} however, there are three egg chambers per ovariole for the first two days, the number then increases to five by day four, but then steadily decreases until there is only an average of one chamber per ovariole by the tenth day. This reduction in the number of egg chambers per ovariole is due to the increasing amount of degeneration present. Although the average number of ovarioles in a singed^{36a} ovary is less than that for wild type the number remains constant over the ten day period studied. The egg chambers within a singed^{36a} ovariole are generally shaped abnormally and packed against one another. This packing is caused by a blocking of the lateral oviducts with degenerating chambers.

Degeneration appears in most chambers at the time when vitellogenesis should start or else develops because yolk synthesis does not commence. In either case degenerating egg chambers are already present in one day old flies. That is, about nine percent of the egg chambers appear pynotic and this degeneracy increases linearly with age up to ten days when most of the egg chambers appear to be dead.