Berg, R.L. Institute of Cytology and Genetics, Novosibirsk-90, U.S.S.R. The inheritance of abnormal abdomen in the offspring of wild males of Drosophila melanogaster.

In 1968 a high frequency of abnormal abdomen (aa) was observed among D. melanogaster inhabiting wineries of Crimea and Transcausasus. 263 aberrant males detected in the fall of 1968 among wild males in the winery Magarach (Crimea, near Nikita Botanical Gardens) were crossed individually with "y w f" or "y f" attached-X females. 88 of these males manifested the character abnormal abdomen (aa), 175 other phenotypical abnormalities. The 88 aa males proved to be bearers of 76 hereditary abnormalities of the abdominal tergites. In the progeny of 13 aa wild males the character did not appear in two subsequent generations. One male out of 75 was heterozygous for two mutations - one sex linked and one autosomal dominant with low penetrance in homozygotes. Out of 76 aa mutations, 4 proved to be sex linked, 72 autosomal (5 recessive and 67 dominant). Out of 67 dominant mutations 17 revealed a 100% penetrance in heterozygotes as well as in homozygotes. 35 mutations were characterised by low penetrance in heterozygotes but the penetrance being high in homozygotes. 12 mutations manifested low penetrance in homozygotes as well as in heterozygotes. In the progeny of three males bearing a dominant aa character with low penetrance in heterozygotes no homozygous flies were observed. In the progeny of 175 males bearing other phenotypical abnormalities the aa flies were found in 37 lines or in 21.1 percent. The genetical analysis showed that out of 37 aa mutations 8 mutations proved to be recessive, 17 dominant with 100% of penetrance in homozygotes and 12 with low penetrance in heterozygotes as well as in homozygotes. The mode of inheritance of aa is strikingly similar to the inheritance of wing venation abnormalities widespread in D. melanogaster populations in past years.

Berg, R.L. Institute of Cytology and Genetics, Novosibirsk-90, U.S.S.R. A sudden and synchronous increase in the frequency of "abnormal abdomen" (aa) in geographically isolated populations of D. melanogaster.

The study of the phenotypical polymorphism in geographically isolated populations of D. melanogaster carried out by me since 1937 revealed a relatively low frequency of the abdominal segmentation abnormalities designated as abnormal abdomen (aa). It was rare till 1968 when a sudden and simultaneous increase in its concentration occurred (Table 1). In 1967 its frequency was not higher than in previous years and no drift was observed. In 1968 the populations of Magarach (Crimea), of Dilizhan and Erivan (Armenia) were studied. The concentrations of aa among males were 2.3, 1.08, 2.9 per cent respectively. 222 aa males were collected and the inheritance of the character was investigated. In 1969 the concentration reached 11.0, 12.2, 13.5 per cent respectively. In the same year the population of Frunze (Kirghizia) contained 7.9 percent of aa males. A hypothesis of the global increase of the aa concentration was put forward and the increase of aa in the other populations predicted. In 1970 three Uman populations as well as two other Ukraine populations - Cherkassy and Zolotonosha - were studied. The character aa was met with 21.4, 18.5 and 17.3 per cent of males in Uman populations and 12.2 and 13.2 per cent in Cherkassy and Zolotonosha. The frequency of aa in females was much higher - 43.9, 42.4, 60.6 in Uman, 40.4 and 37.8 per cent in Cherkassy and Zolotonosha, respectively. The Frunze population contained in 1970 14.5 per cent of aa males and 52.2 per cent of aa females. In 1971 the three Uman populations and that of Frunze were investigated again. The concentration of aa males in Uman decreased significantly (Table 1). In Frunze a significant decrease was observed among females. Six other populations were investigated during 1971 - three Transcaucasian (Dilizhan, Erivan, Burakhan), the population of Magarach, of Baku (Azerbaijan) and of Vladivostok (Far East). A slight increase was observed in Erivan, all other indices being constant. All "new" populations revealed a high frequency of aa comparable to that observed in populations previously studied. The concentration of aa was lower in Vladivostok - the single population investigated not by myself but by Dr. J.N. Ivanov who used however the same method of registration of aa as I did. The parallel with the sickle cell anemia in man seems clear. The simultaneous increase in geographically isolated populations in frequencies of a gene complex causing harmful developmental abnormalities and at the same time securing resistance is supposidly dependent on some pandemic fly disease acting as a powerful positive selective factor.

Concentration of "abnormal abdomen" phenotype in geographically isolated populations of Drosophila melanogaster

	Population	Year	MALES n	MALES number	MALES percent	FEMALES n	FEMALES number	FEMALES percent
Moscow district	Kashira	1940	1282	1	0.08	980	4	0.41
	Serpukhov	1940	190	0	0	185	0	0
	Kashira	1960	1601	4	0.25	420	1	0.24
		1962	243	1	0.41	283	0	0
Ukraine	Uman	1937	10159	8	0.08	10543	5	0.05
	Odessa	1946	1584	2	0.13	1963	3	0.15
	Uman	1946	3652	9	0.25	2292	13	0.57
		1963	1509	1	0.07	651	1	0.15
		1970	1544	293	19.0	1142	567	49.6
	Cherkassy	1970	584	71	12.2	502	203	40.4
	Zolotonosha	1970	660	87	13.3	749	283	37.8
	Uman	1971	1516	124	8.2	1236	585	47.3
Moldavia	Tiraspol	1946	6016	8	0.13	5441	10	0.18
		1962	1382	1	0.07	1533	5	0.39
Crimea	Nikita	1937	7115	3	0.04	5204	5	0.10
	Botanical Gardens	1938	1260	0	0	1446	2	0.14
	+ Magarach	1960	4081	5	0.12	5287	8	0.15
	Magarach	1963	1279	1	0.08	1678	4	0.24
		1965	7988	15	0.19	426	0	0
		1966	5000	16	0.32	-	-	-
		1967	6502	21	0.32	-	-	-
		1968	5302	121	2.28	-	-	-
		1969	661	73	11.04	-	-	-
		1971	876	97	11.07	539	303	56.2
Caucasus	Nalchik	1957	539	0	0	581	0	0
	Inozemtsevo	1957	1546	2	0.13	1180	2	0.17
	Pyatigorsk	1957	3702	3	0.08	4258	4	0.09
Trans-caucasus	Kutaissi	1945	6564	5	0.08	5828	6	0.10
	Dilizhan	1939	5238	5	0.10	4462	3	0.07
		1960	1024	2	0.20	1339	1	0.08
		1961	1306	1	0.08	-	-	-
		1962	272	0	0	310	1	0.32
		1964	300	0	0	270	0	0
		1965	318	2	0.63	307	0	0
		1966	179	1	0.56	-	-	-
		1967	326	1	0.31	-	-	-
		1968	278	3	1.08	-	-	-
		1969	793	97	12.23	-	-	-
		1971	836	115	13.76	862	317	36.8
	Erivan	1939	2759	1	0.04	2548	0	0
		1961	1526	0	0	228	0	0
		1965	3778	2	0.05	824	1	0.12
		1967	2109	1	0.05	-	-	-
		1968	3434	98	2.85	-	-	-
		1969	1684	228	13.54	-	-	-
		1971	471	80	17.00	541	279	51.6
	Burakhan	1971	333	41	12.31	280	128	45.7

(Table continued next page)

Table 1 (Continued)

	Population	Year	MALES n	MALES number	MALES percent	FEMALES n	FEMALES number	FEMALES percent
	Lenkoran	1967	1148	0	0	-	-	-
	Baku	1971	158	18	11.39	294	111	37.8
Middle	Alma Ata	1961	2013	0	0	1625	3	0.19
Asia	Frunze	1969	1668	132	7.9	-	-	-
		1970	595	86	14.5	412	215	52.2
		1971	699	97	13.9	551	200	36.3
Far East	Vladivostok	1971	185	13	7.0	219	40	18.3

Grell, R.F. Oak Ridge National Laboratory, Oak Ridge, Tennessee. Viability of tetra-4 flies.

A number of papers concerned with meiotic mutants and their effects on segregation have been published recently. In each paper it has been stated or tacitly assumed that the tetra-4 genotype is lethal; no provision has been made to distinguish it phenotypically from the triplo-4 fly; and segregation analysis has proceeded on this assumption. When a reference to the lethality of the tetra-4 is cited, it is E.H. Grell (1961). However, the purpose of the Grell paper was to demonstrate that tetra-4 flies do survive, although under the conditions of the experiment they appeared infrequently. As pointed out by Grell, their rare appearance was attributable, at least in part, to the segregation pattern required for their recovery - namely, that all three parts of the double X:4 translocation, T(1:4)w^{m5}T(1:4)B^S, move to the same pole at meiosis I in both the heterozygous translocation-bearing mother and the hemizygous translocation-bearing father. Further, his scheme precluded the recovery of a tetra-4 male, since the recovery of two X chromosomes necessarily accompanied the recovery of the four 4's.

Recent studies by Moore and R.F. Grell (1972) have established that the very low recovery of tetra-4 flies with the translocation method was largely segregational in origin. The Moore and Grell experiments utilized compound-4's constructed by Lewis and Roberts (E.H. Grell, 1963), and in the course of the work they recovered tetra-4's in large numbers. As shown in Table 1, crosses of diplo-4 mothers carrying a compound-4, phenotypically wild-type, to triplo-4 fathers carrying a compound-4 homozygously marked with ci and ey^R as well as a single 4 marked with ci^D produced diplo-4, triplo-4, and tetra-4 progeny which were phenotypically distinguishable as ci ey^R, ci^D, and +, respectively. In the first set of crosses, approximately 26% of the 90,128 progeny were tetra-4; in the second set, approximately 24% of the 27,786 progeny were tetra-4 (Table 1, col. 4 and 5). Viability of the tetra-4 is calculated to be 76% of the diplo-4 and 63% of the triplo-4 in the first set of crosses and 68% and 58%, respectively, in the second set. Marker-wise, the tetra-4 possesses a viability advantage since it is wild-type. Nevertheless it is clear that the tetra-4 is far from lethal, and genetic experiments which fail to distinguish the tetra-4 from the triplo-4 on the grounds that it is must contain some error.

Table 1. Numbers of diplo-4, triplo-4 and tetra-4 progeny from crosses of C(4)RM, ci ey^R/gvl sv^n ♀♀ x C(4)RM, ci ey^R/ci^D ♂♂

Set	diplo-4 (ci ey^R)	triplo-4 (ci^D)	tetra-4 (+)	Total	Viability of tetra-4 % of diplo-4	Viability of tetra-4 % of triplo-4
1	30,357	36,581	23,190	90,128	76	63
2	9,764	11,429	6,593	27,786	68	58

References: Grell, E.H. 1961 Genetics 46:1177-1183; Grell, E.H. 1963 Genetics 48:1217-1229; Moore, C. and R.F. Grell 1972 Genetics (in press).

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