

THE INFLUENCE OF ENVIRONMENT ON INHERITANCE OF TWO CHARACTERS IN *DROSOPHILA**

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SINCE VARIOUS mutations of *Drosophila melanogaster* depend on a definite environment for the realization of the character, the author tried the effect of a reduced temperature on various stocks. Ten stocks of *Drosophila melanogaster* were subjected to low temperatures in order to determine how these stocks would react. Would new mutations result or would the new environment bring out characters already in these stocks? Would it act as does the environment in bringing to full realization such mutations as abnormal abdomen, barred eyes, tumors, extra legs, etc.?

The ten stocks chosen were apricot, jaunty, beadex, bifid, dumpy, eyeless, scute, small eye, vestigial and vibrissae. Mass cultures of these stocks were allowed to lay. The eggs, when only a few hours old, were placed in cold rooms and kept at temperatures of either 10° or 14°. Eggs of the same flies were kept at room temperature for controls. The bottles were allowed to remain in the cold room until the flies had reached the late larval or early pupal stage. When the resulting flies hatched, a number of abnormalities were observed. These were of various kinds and included blistered wings, turned up wings, rumped wings, hunch wings, jaunty wings, abnormal abdomens and extra legs. An average of 5.5% of abnormalities resulted from the eggs treated with reduced temperature and .5% from the controls. From one bottle of the treated stocks, small eye, 10 of the 51 flies which hatched, or 19%, were blistered wing animals.

The flies chosen for parents of new lines were the abnormal individuals resulting from the eggs which had been kept at low temperature. They included seven lines with abnormal abdomens, nine with peculiar wings, five with peculiar or extra legs and one with abnormal thorax. Progeny of all ten of the original treated stocks were included in these lines. These abnormal flies were mated, usually to brothers and sisters. When abnormalities of the two sexes occurred in one bottle, these were mated; otherwise the abnormal flies were mated to normal brothers and sisters. These flies are referred to throughout the paper as parents. The F₁ developed at room temperature. Among the F₁ the percent of abnormality like the original parent was usually small, but varied from 1% to 29%. The F₁ flies showing 29% abnormality were blistered and were the offspring of the blistered parents mentioned above, and whose original stock was small eye.

Among the F₂, in addition to those abnormalities which were like the original parent, there appeared also abnormalities not like those of the original parent. In one case, 29% of blistered wings appeared among the F₂ from the queer leg parent whose original stock was beadex. Blistered wings appeared among the F₂ of six stocks, although observed only in one bottle among flies coming from eggs directly treated with cold. Similarly abnormal abdomen appeared among F₂ of four lines not selected for the character.

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The F_1 flies were bred inter se. These eggs were treated with reduced temperature and controls were kept. Among the F_2 from un-iced controls, the percent of abnormality like the original parent was usually small, but in two cases was 46%, one case being the F_2 blistered from blistered parent of small eye stock. Among F_2 iced flies, the percent of abnormality like the original parent varied from 0% to 37%, several of the iced stocks showing a larger percent of the abnormality than did the un-iced controls.

The most interesting thing found was that in the F_1 , and especially in the iced F_2 , abnormalities other than those of the original parent developed. Blistered wings and abnormal abdomen were the two characters which appeared most frequently. Among the F_2 , blistered wings appeared, some in uniced and some in iced bottles, and in one of the abnormal abdomen lines. Similarly abnormal abdomen appeared in six of the seven wing stocks carried this far.

The two characters, abnormal abdomens and blistered wings, were studied more intensively. Five abnormal abdomen stocks and three blistered wing stocks were carried on. The five abnormal abdomen stocks carried on had originated from *visrussae*, acute, eyeless bifid and apricot. The blistered wing stocks had originated from bifid and beadex. Blistered wings have appeared in considerable numbers in three of the five abnormal abdomen stocks and abnormal abdomen in two of the three wings stocks.

Several questions arise as a result of the findings. Has the reduced temperature caused new mutations and to what extent are these mutations dependent on the environment for their realization? The conclusion that the treatment with cold has caused these two new mutations seems obvious. Since these characters appeared repeatedly in considerable numbers either among the flies hatching from iced eggs, or in the generations following, and since a number of the stocks started with these abnormal flies continued to throw the abnormalities for a number of months, the conclusion that reduced temperature has brought about these mutations is justified.

Although the two abnormalities continued in subsequent generations, only two of the abnormal abdomen stocks threw a considerable number of flies with the abnormal abdomens. Three of these stocks, however, continued to throw blistered wings to a large extent and also some months, the stocks, which must have been relatively pure, did not yield large proportions of the abnormalities.

Two series of experiments were next undertaken to determine if larger numbers of the abnormalities could be obtained by providing a definite favorable environment. The two kinds of environment selected were temperature and humidity. Eggs from the several abnormal abdomen and blistered wing lines were subjected to cold. The eggs were left in the ice box until the pupae began to develop. Controls were kept at room temperature. In general, the results showed that temperature has no immediate effect of increasing the percentage abnormal abdomen, for the percent of the abnormal abdomens was about as great in the un-iced bottles. In four of these abnormal abdomen stocks of beaded and blistered appeared in either iced or uniced bottles. We would conclude that, although reduced temperature caused the abnormal abdomen, it is not the environmental factor favorable for its expression. The results after treating the blistered wing stocks with reduced temperature were quite different. They were as follows:

Reduced Temperature			
	Blistered	Non-blistered	Percent blistered
Wing 1	12	63	16.
Control	6	193	3.
Wing 3	12	16	42.8
Control	15	135	10.
Wing 5	31	30	50.
Control	47	109	30.1

In each of the three wing stocks the percent of blistered wings was considerably higher when the eggs had been iced than in the controls. In this case we have found an environment which will help to bring out the appearance of the mutation.

The blistered stocks are evidently sex-linked and semi-lethal, since most of the blistered are females. Blistered also seems to go along with beaded and may be another expression of the same gene.

The abnormal abdomen stocks were next treated with three grades of humidity. Eggs from the same parents were grown in bottles saturated with moisture, in moderately moist bottles and in dry bottles. Only one of the abnormal abdomen stocks showed sufficient numbers of the abnormal abdomen flies to make the results significant. In the case of this stock, *abab3*, the numbers of flies were larger and indicative of the part played by the environment.

	Abnormal	Normal	Percent Abnormal
Very moist	42	247	12.2
	9	118	
	—	—	
	51	365	
Moderately moist	276	895	17.7
	104	867	
	—	—	
	380	1762	
Dry	30	1052	3.2
	14	275	
	—	—	
	44	1327	

Obviously the abnormal abdomen develops best under moderately moist conditions. This abnormal stock is not sex-linked and thus is not the same as that found by Dr. T. H. Morgan which was a sex-linked character.

SUMMARY

Treatment of ten stocks of *Drosophila melanogaster* to reduced temperature brought out two new mutations—blistered wings and abnormal abdomen. These two characters appeared frequently among the progeny of iced flies. One of the two blistered wing stocks depends partly on reduced temperature for its fulfillment and one abnormal abdomen stock similarly depends somewhat on a moderate amount of moisture for its fulfillment. We thus have two more characters added to the list of those whose expression is partly a result of the environment.