Sulerud, R.L. Augsburg College, Minneapolis, Minnesota. Two types of sensitivity to carbon dioxide in D. affinis.

Two CO_2-sensitive strains of D. affinis were established from isolated wild-caught affinis subgroup females (Minneapolis, Minnesota) in 1968. These strains were designated S35 and S52. Resistant strains designated R48 and R50 were also established at that time. "Sensitivity" was determined by a failure to recover from a 15 minute exposure to pure CO_2 at 14°C (standard test).

Reciprocal crosses have been made of S35 and S52 flies to R48 flies. The recovery of progeny from a standard CO_2 test is shown in Table 1.

Table 1.

	R48♀ x S35♂ (N=410)		S35♀ x R48♂ (N=191)		R48♀ x S52♂ (N=760)		S52♀ x R48♂ (N=360)	
Rec. time	N rec	% rec	N rec	% rec	N rec	% rec	N rec	% rec
15 min.	232	57	0	0	341	45	0	0
30 min.	254	62	0	0	534	70	0	0
1 hr.	283	69	0	0	625	82	0	0
2 hrs.	286	70	0	0	642	84	0	0
4 hrs.	285	70	0	0	645	85	0	0

Carbon dioxide sensitivity was efficiently transmitted maternally in both strains, but paternal transmission was only partial. None of the progeny produced by sensitive females recovered, whereas after four hours the recovery percentages for progeny of S35 and S52 males crossed to resistant females were 70 percent and 85 percent respectively. Recovery often required longer than 15 minutes (maximum recovery time for resistant flies), especially for progeny of S52 males. Therefore, if the percentage of sensitive progeny is determined by failure to recover within 15 minutes after testing, S52 males would be considered to have transmitted sensitivity more efficiently than S35 males (55 percent and 43 percent non-recovered progeny respectively).

Another difference between the S35 and the S52 strains was revealed by testing the two strains at various temperatures. Flies of resistant strains R48 and R50 were tested for comparison, as shown in Table 2.

Table 2.

Temp. °C	R48 and R50		S35		S52	
	rec/N	% rec	rec/N	% rec	rec/N	% rec
4	112/112	100	0/108	0	25/122	20
9	40/40	100	0/37	0	7/26	27
14	70/70	100	2/102	2	39/220	18
19	69/70	99	9/16	56	5/33	15
24	108/110	98	23/23	100	7/34	21
28	70/70	100	34/34	100	2/36	6
30	64/71	90	65/72	90	0/64	0

Few if any S35 flies recovered when tested at temperatures of 14°C or lower, but when tested at 24° or 28°C they all recovered and all but seven flies recovered following a 30°C test. In contrast, all but two S52 flies failed to recover when tested at 28°C, and no flies of this strain recovered from the 30°C test. Between 15 percent and 27 percent recovery took place when S52 flies were tested at temperatures below 28°C. Although not shown in the table, this recovery usually took longer than 15 minutes.

The inability of S52 flies to recover at higher testing temperatures and the delay in recovery beyond 15 minutes from testing at lower temperatures are features which are shared by "delayed-recovery" melanogaster as described by McCrady and Sulerud, 1964. However, delayed-recovery in melanogaster is due to a third chromosome gene, while in affinis a cytoplasmic agent is implied by the maternal inheritance of the condition. Characteristics of S35 sensitivity are more similar to the well-known CO_2 sensitivity in melanogaster caused by virus sigma. Injection experiments have not been conducted to determine whether an infectious agent

is involved in either S35 or S52, but such an agent has been demonstrated in other affinis strains by Williamson, 1961, and others.

Unfortunately both S35 and S52 have been lost in a fire, but new CO_2 sensitive affinis strains are now being established with the aim of studying the variation in sensitivity which seems to exist in this species.

References: McCrady, W.B. and R.L. Sulerud, 1964 Genetics 50:509; Willismson, D.L. 1961, Genetics 46:1053.

Søndergaard, L. University of Copenhagen, Denmark. Studies on the behavour of the paralytic mutant Out-cold^{ts}.

When females heterozygotic for Ocd^{ts} are transferred from 25°C to 19°C (or below) they show a constant sequence of behavoural patterns: 1) uncoordinated movements of the legs so that they fall on their backs, 2) flexion of the first and strong deflexion of the second and third pairs of legs, 3) flutter of the wings so that the flies flop around in the vial (20% of the flies do not show wing flutter). After this sequence the legs are relaxed and the flies are immobilized. When shifted back to 25°C immobilized flies recover mobility within 1-5 min dependent upon how long they have been kept at a low temperature. The duration of the behavoural patterns 1 and 2 does not vary between specimens, but varies with the magnitude of temperature shift down from 25°C (Fig. 1).

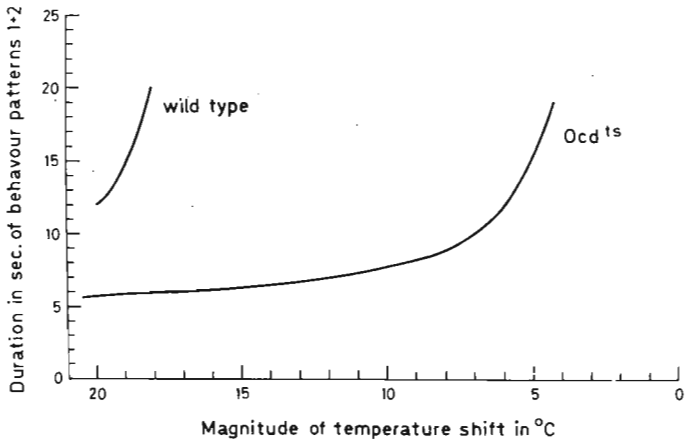

fig.1

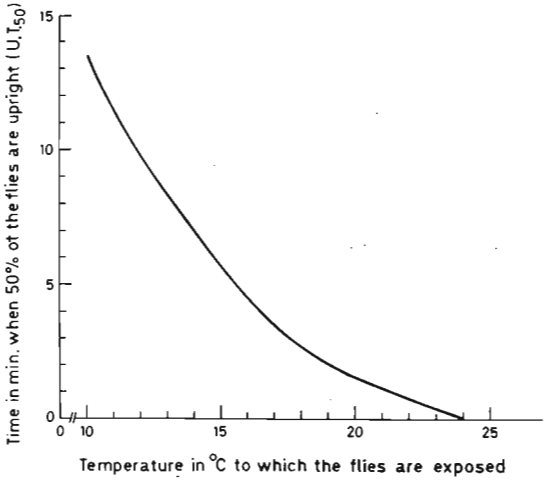

fig. 2

Even when flies are shifted from 25°C to between 20°C and 23°C they are affected, but an increasing number show only uncoordinated leg movements (39% at 20°C and 80% at 23°C).

Paralyzed flies kept at low temperatures regain normal behavour after some time (Fig.2). Wild type flies when shifted to a temperature of 7°C show a similar behavour, but take a longer period of time to become paralyzed.

Ocd^{ts} males at 25°C walk in a reeling manner and fall over frequently; only after a long period of time of kicking do they rise again. Usually only about 50% of the males in a population are upright at a given time. About 40% hold their wings in a drooped position. Ocd^{ts} males are smaller than normal males, and tend to stick in the media immediately after eclosion. They are weak and even when prevented from drowning they will not survive for 48 hours. The males as well as the females are affected by low temperatures. Although incapable of flying, they flutter their wings after cold shocks, as do the females.

Ocd^{ts} flies show leg shaking when etherized, although not as much as the mutant HK_2. Etherized flies and flies injected with tubocurare will show no paralytic behavour in connection with cold shocks. Wild type flies fed a sublethal dose of DDT behave as a phenocopy of Ocd^{ts} males. These observations suggest that Ocd^{ts} mutants are in some way affected in the nervous system.