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Responses of cervical connective fibers to visual pattern movement in wild type Drosophila melanogaster.

In female wild type D. melanogaster (stock Berlin) the fused pair of cervical connectives contains 3578 nerve fibers. Their mean diameter is about 5 μm in the two dorsal "giant fibers", 1-3 μm in another set of 70 fibers, and less than 1 μm in the remaining 3506 fibers. The smallest profiles have diameters of less than 0.1 μm. Action potentials of at least some of the larger fibers can be recorded for several hours from the intact connective by means of metal hook electrodes. The records show a continuous spontaneous activity, which fluctuates in time, and which specifically changes in response to visual stimulation. The stimulus consisted of striped patterns, moving at constant speed across translucent screens in front of the two compound eyes. If the patterns on either side move horizontally from front to back, the spike rate in the cervical connective increases to about twice the resting activity. This effect lasts until the movement comes to rest. Pattern movement in the reverse direction elicits very small if any responses. Monocular stimuli give rise to similar but smaller responses than binocular ones. Horizontal rotatory stimuli on both eyes are equivalent to front-to-back stimuli on one eye alone. If the direction of pattern movement is varied with respect to the long axis of the fly, the response is found to be largest for horizontal pattern movement from front to back. Vertical movement is almost ineffective. Varying the speed of pattern movement yields a maximum of the response beyond $w=400^{o}$/sec with patterns of $\lambda=40^{o}$ spatial wavelength.

Studies are under way to analyze, in more detail, the characteristics of these responses, and to establish their relation to visually controlled behavioral traits.

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Quantitative measurement of red eye pigment in various white mutants of Drosophila melanogaster.

Eyes of wild type Drosophila melanogaster contain two distinct types of pigment, ommochromes (brown) and pteridines (red). The ommochromes are found in most arthropod groups and the biochemcial pathways of these pigments are well known. Pteridines, on the other hand, are unique to Drosophila and their synthesis has not yet been fully elucidated, although some biochemical and physiological information is known.

In reviewing the literature for reports of quantitative measurements of pteridine pigments found in female flies homozygous and heterozygous (with white) for the various alleles at the white locus, we found that such precise information generally either was not available or not comparable. Therefore, we found it necessary and useful to determine these values ourselves for 20 white alleles, wild type (Oregon-R), brown and scarlet mutants. See Table 1 for a listing of these stocks; see Lindsley and Grell (1968) for full descriptions. All stocks were obtained from the Bowling Green Stock Center.

All flies were raised at 25 ± 1°C on a standard dextrose, agar, Brewer's yeast medium containing Tegosept-M as a mold inhibitor. Pigment determinations were obtained on two groups of flies: females homozygous for the genes listed in Table 1, and heterozygous females obtained by crossing females homozygous for the gene in question with white eyed hemizygous males. Flies were aged a minimum of five days post-eclosion before the pigment extraction procedure was begun. The method of Ephrussi and Herold (1944) was followed in extracting the pteridine eye pigment. In each case, 100 females were etherized and then decapitated with a surgical steel blade (size 11). The heads were next split in half vertically and collected with a small camel's hair brush to be put into four ml of Acid Ethyl Alcohol (AEA) solution, where they remained for 20-22 hours at 25 ± 1°C. After the required time, the solution containing the eyes was spun in a Beckman centrifuge for 15 minutes at 15,000 x g to separate the eyes from the pigment which had dissolved in solution. Three ml of the solution was then transferred into a quartz cuvette and placed into a Perkin-Elmer 124-D Double Beam Spectrophotometer in order to measure absorption. The reading at 480 milli-microns was taken as the

Table 1. Pteridine pigment values of female Drosophila melanogaster (25 heads per 1 ml of AEA)

Mutant Tested	Genotype	Absorbance at 480 milli-microns	Mutant Tested	Genotype	Absorbance at 480 milli-microns
1. w^{m4}	w^{m4}/w^{m4}	1.600	13. w^{ec3}	w^{ec3}/w^{ec3}	0.000
	w^{m4}/w	0.565		w^{ec3}/w	0.009
2. w^{co}	w^{co}/w^{co}	0.158	14. w^{bf2}	w^{bf2}/w^{bf2}	0.012
	w^{co}/w	0.060		w^{bf2}/w	0.003
3. w^{e}	w^{e}/w^{e}	0.131	15. w^{bux}	w^{bux}/w^{bux}	0.013
	w^{e}/w	0.057		w^{bux}/w	0.044
4. w^{a3}	w^{a3}/w^{a3}	0.110	16. w^{i}	w^{i}/w^{i}	0.010
	w^{a3}/w	0.054		w^{i}/w	0.002
5. w^{a2}	w^{a2}/w^{a2}	0.086	17. w^{bf}	w^{bf}/w^{bf}	0.013
	w^{a2}/w	0.042		w^{bf}/w	0.012
6. w^{col}	w^{col}/w^{col}	0.084	18. w^{h}	w^{h}/w^{h}	0.017
	w^{col}/w	0.046		w^{h}/w	0.031
7. w^{bl}	w^{bl}/w^{bl}	0.061	19. w^{t}	w^{t}/w^{t}	0.013
	w^{bl}/w	0.031		w^{t}/w	0.005
8. w^{sat}	w^{sat}/w^{sat}	0.074	20. w	w/w	0.005
	w^{sat}/w	0.063			
9. w^{a}	w^{a}/w^{a}	0.037	21. OR-R	$+^{w}/+^{w}$	1.894
	w^{a}/w	0.025		$+^{w}/w$	1.696
10. w^{a4}	w^{a4}/w^{a4}	0.029	22. bw	$+^{w}/+^{w}$, bw bw	0.048
	w^{a4}/w	0.038		$+^{w}/w$, $+^{bw}$ bw	1.612
11. w^{e2}	w^{e2}/w^{e2}	0.037	23. st	$+^{w}/+^{w}$, st st	1.799
	w^{e2}/w	0.034		$+^{w}/w$, $+^{st}$ st	1.917
12. w^{ch}	w^{ch}/w^{ch}	0.035			
	w^{ch}/w	0.025			

peak absorption value, although we wish to note that there was, in some cases, an extremely broad peak from about 480 to 460 milli-microns. The 480 milli-micron value was taken as the peak due to convention. Prior to each reading, a previously collected sample of pigment from scarlet homozygous females was run in order to standardize the spectrophotometer so that data collected at different times would be comparable. Single readings were made for most of the genes tested. However, second readings, from new crosses, were taken for those white alleles which showed a heterozygous value much lower than the homozygous value. In all these cases, the data from the two runs were quite similar, and the values presented in this report are the average of the two runs.

The values obtained are presented in Table 1. Note that of the 20 white alleles tested, 12 of them (numbered 1-12 in the table) gave homozygous values of greater than 0.020 (values lower than 0.020 are too low to be reliably determined on the instrument we used). Of these 12 white alleles giving high homozygous values, seven of them (1-7 in the table) gave heterozygous values of approximately one-half the homozygous value, indicating that for pteridine pigment synthesis these seven white alleles show incomplete dominance in relation to white. The white alleles we tested which gave reasonable amounts of red pigment and which also gave similar values in homozygous and heterozygous conditions were numbers 8 through 12 in the table. Therefore, for pteridine pigment synthesis, these five alleles show more or less complete dominance over white, according to our data.

References: Ephrussi, B. and J.L. Herold 1944, Genetics 29:148-175; Lindsley, D.L. and E.H. Grell 1968, Carn. Inst. Wash. Pub. No. 627.