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Gain differences of gaze-stabilizing head movements, elicited by wide-field pattern motions, demonstrate in wildtype and mutant *Drosophila,* the importance of HS- and VS-neurons in the third visual neuropile for the control of turning behaviour.

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Head movements in *Drosophila,* that stabilize the eyes relative to the surroundings, have been studied by micro-videography. Like other diptera {1}, *Drosophila* can turn its head in all directions: yaw ± 25°, pitch ±35°, and roll ± 120°. In flight, the head is pitched downwards by 23.0°±7.5° SD, compared to the resting fly. This modification of head posture compensates, at least partly, for the increased body elevation at average flight speeds (walking: ε = 15.0° ± 4.2° SD, flying: ε = 45.5° ± 13.0° SD).

At rest, *Drosophila* holds its head still, unless stimulated. During walking and flight it turns the head spontanously, in a characteristic manner, in all directions. Since flies do not respond to gravity during flight {1}, *Drosophila,* can be mounted in arbitrary orientations in the center of a striped drum to elicit head/eye movements in different directions. When the pattern is moving back and forth (pattern speed = 24°/s; spatial wavelength = 24°), *Drosophila* turns its head in the same direction, and thus reduces the apparent pattern motion by about 65% in flying flies, and by about 80% in resting flies.

This stabilization of the fly's head and eyes maintains an upright orientation of the retinal image of the surroundings, and reduces motion blurring and other visual disturbances. Thereby a degradation of visual abilities is largely prevented.

Wildtype flies have, in the third visual neuropil (lobula plate), two prominent groups of interneurons (HS, VS) which are thought to respond to coherent wide-field pattern motion in a directionally specific manner. Their signals are believed to contribute significantly to the control of turning reactions.

In the neurological mutants *"optomotor blind* H^{31} and *"ruby*^{5}*",* the neuroblasts of these interneurons do not develop during embryogenesis, and hence the cells are not present in the imagines. Consequently, the adult flies show largely reduced optmotor turning responses during walking and flight {2}. The mutant flies have normal head mobility; they turn their head spontaneously and pitch it downwards at flight start very much like wildtype flies. Hence their neck joint, muscles, motoneurons and motor coordination appear to be unaffected by the mutations. The mutant flies lack, however, completely the head turning responses, elicited in wildtype flies by wide-field pattern motion.

These findings extend the description of the phenotypes of the mutants *"optomotor blind ,*H^{31}*„* and *"ruby* ^{5} *",* and prove the notion that HS- and VS-neurons are major components in the pathway controlling various turning responses of flies that depend upon wide-field visual motion.

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