**Mechanisms of plasticity in simple taxis behaviors in Drosophila**

Marc-Nicolas Rentinck, Benjamin Beuster, Björn Brembs

PU Berlin, Institut für Biologie - Neurobiologie, Königin-Luise-Strasse 28/30, 14195 Berlin, Germany

bjoern@brembs.net, http://brembs.net

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**1. Introduction**

Like the proverbial moth drawn to the candle flame, the fruit fly Drosophila also shows taxis responses driven by a central decision-making stage influenced by the stimulus and response. Therefore, there may be a central decision-making stage which is influenced by the hypothesis that instead of taxis being a simple matter of stimulus and response, there can be an internal development stage which is influenced by the main manipulations.

**2. Methods**

Wings were manipulated under CO2 anesthesia in groups of 50 flies (24 were manipulated and 25 were left intact). The flies were then loaded into the translucent cups of the Benzer counter-current apparatus, consisting of five target and six source tubes (see figure). Flies were tested for phototaxis with the apparatus oriented horizontally, with the target tubes towards a fluorescent tube. Flies were tested for walking activity without sensory cues in the dark with the apparatus oriented horizontally. A phototaxis run lasted 15s, a geotaxuis run 30s and a walking activity run 60s. After 5 runs the experiment was ended and the flies were counted.

**3. Results**

- **Fly strains used**
- **a) Recovery time**
- **b) Different wildtype strains**
- **c) Learning and memory**
- **d) Flight ability**
- **e) Vision**

**4. Conclusions**

Plasticity in simple behaviors not to simple

Single axis behaviors are considered to be hard-wired input-output systems: the sensory input triggers motor output via developmentally determined neuronal connections. Examples of such cephalic behaviors include the photo- and geotaxis tested here. However, even such single behaviors show a degree of plasticity, making flies whose wings have been impaired become less responsive to visual cues after a period of adaptation. Indeed, they show less walking activity in general.

Robust plasticity

We have tested a large number of different wildtype and transgenic strains for their plasticity in phototaxis and geotaxis as well as in general walking activity after clipping of their wings. In all but a few cases, the flies show a significant decrease in taxis. In all but a very few cases, the flies show a significant decrease in taxis. Even clipping wings only affects taxis and movement is preserved. For example, a clipper mutant (fly) does not decrease further when the wings are clipped. Interestingly, the lack of re-orientation walking activity appears to have little impact on the reduction in phototaxis.

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**Fly strains used**

- hs-GAL4 - Heat-shock activated GAL4 driver line
- rsh; hs-rsh (161) - mushroom-body specific GAL4 driver line
- mb247 - gene, white eyes
- CNT-E - Tetanus Toxin light chain (UAS effector gene), suppresses synaptic release
- vestigial - Allele of the vestigial gene, white eyes
- w10 - w10 is a null mutant for the white gene, which results in white eyes.
- hs-GAL4 - Heat-shock activated GAL4 driver line
- PKCi - Inhibitory peptide suppressing Protein Kinase C activity (UAS effector gene).
- norpA - norpA is a null mutant for the norpA gene, which results in an absence of synaptic transmission.