Differences in orientation behaviour underlie interclonal differences in phototaxis in *Daphnia magna*

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With 7 figures and 2 tables in the text

Abstract: I studied the orientation direction of the body and the eye in response to contrasts in *Daphnia magna*. The orientation of the body was studied on pinned, but freely rotating daphnids, and on freely swimming daphnids. The orientation direction of the eye was studied on daphnids with a fixed position of the body axis. Daphnids were pinned on a needle in the middle of a circular fluorescent tube. When part of the light was screened off, introducing two contrasts, orientation of the body followed. Two dominant orientation positions were observed: a negative orientation, with the head directed away from the illuminated area, and a positive orientation, with the head directed towards the illuminated area. I studied four clones and these appeared to orient in quite different ways. In three clones, chemicals associated with predatory fish changed the orientation of the body to a more negative one. Contrast orientation of freely swimming daphnids was studied in order to investigate if the contrast orientation influenced the body position of freely moving daphnids correspondingly. Also in this case, position of the contrasts determined the orientation of the body, and thereby the swimming direction. Finally, the contrast orientation of the eye was studied on daphnids with a fixed body position. Within a certain tracking range, the orientation of the eye was strongly related to the position of the contrasts. Chemicals associated with the predatory fish did not affect this relation.

Introduction

Many zooplankton species show a distinct vertical distribution. These vertical distributions may change in response to diel and seasonal circumstances (Cushing 1951, Hutchinson 1967, Haney 1988). Diel changes in light intensity may cause swimming responses in *Daphnia* that result in vertical migration (Ringelberg 1964, McNaught & Hasler 1964). If and to what extent