

## PAR and UV Effects on Vertical Migration and Photosynthesis in *Euglena gracilis*<sup>†</sup>

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### ABSTRACT

Recently it was shown that the unicellular flagellate *Euglena gracilis* changes the sign of gravitaxis from negative to positive upon excessive radiation. This sign change persists in a cell culture for hours even if subsequently transferred to dim light. To test the ecological relevance of this behavior, a vertical column experiment was performed (max. depth 65 cm) to test distribution, photosynthetic efficiency and motility in different horizons of the column (surface, 20, 40 and 65 cm). One column was covered with a UV cut-off filter, which transmits photosynthetically active radiation (PAR) only, the other with a filter which transmits PAR and UV. The columns were irradiated with a solar simulator (PAR 162 W m<sup>-2</sup>, UV-A 32.6 W m<sup>-2</sup>, UV-B 1.9 W m<sup>-2</sup>). The experiment was conducted for 10 days, normally with a light/dim light cycle of 12 h:12 h, but in some cases the light regime was changed (dim light instead of full radiation). Under irradiation the largest fraction of cells was found at the bottom of the column. The cell density decreased toward the surface. Photosynthetic efficiency, determined with a pulse amplitude modulated fluorometer, was negligible at the surface and increased toward the bottom. While the cell suspension showed a positive gravitaxis at the bottom, the cells in the 40 cm horizon were bimodally oriented (about the same percentage of cells swimming upward and downward, respectively). At 20 cm and at the surface the cells showed negative gravitaxis. Positive gravitaxis was more pronounced in the UV + PAR samples. At the surface and in the 20 and 40 cm horizons photosynthetic efficiency was better in the PAR-only samples than in the PAR + UV samples. At the bottom photosynthetic efficiency was similar in both light treatments. The data suggest that high light reverses gravitaxis of the cells, so that they move downward in the water column. At the bottom the light intensity is lower (attenuation of the water column and self shading of the cells) and the cells recover. After recovery the cells swim upward again until the negative gravitaxis is reversed again.

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