



Contribution ID: 40

Type: Poster

Changes in the phototactic behavior of *Chlamydomonas reinhardtii* resulting from the integration of past light stimuli

Organisms such as *Chlamydomonas reinhardtii* use phototaxis to explore their environment and find the best conditions for photosynthesis. In our work, we study the phototactic behavior of suspensions of *C. reinhardtii* confined within shallow cylindrical wells, and exposed to directional light stimuli of various intensities. We recover known results: at low light intensities, the algae exhibit positive phototaxis, at high light intensities, negative phototaxis and at intermediate light intensities, we find that the behavior depends on past phototactic stimuli, in a way that is the opposite of an adaptive behavior [1], [2] and [3].

It is known that cells adapt to previous stimuli, and that stimulating *C. reinhardtii* multiple times with an identical high light intensity leads to different responses; the first stimulus leads to negative phototaxis, while after several stimuli, the algae exhibit positive phototaxis, as if they sensed a lower stimulus [4] and [5]. In our experiments at intermediate light intensities, we highlight a behavior that is the opposite of adaptation: cells integrate the signal over time. Applying the same stimulus twice at a couple minutes interval leads to a change in phototactic response, from positive phototaxis to negative phototaxis, such that the response to the second stimulus is the same as if the light was of higher intensity. Waiting a couple hours between the experiments allows to recover the original positive phototactic behavior. A simplified model of phototaxis is introduced, where the time-integration of light stimuli results from the interplay between the underlying biological time scales and the time scales of the light stimuli. The outcome of the model captures qualitatively our experimental results.

References

- [1] Witman, G. B. Trends in cell biology (1993)
- [2] Schaller, K., David, R., and Uhl, R. Biophysical journal (1997)
- [3] Arrieta, J., Barreira, A., Chioccioli, M., Polin, M., and Tuval, I. Scientific reports (2017)
- [4] Mayer, Nature 217, 875 (1968)
- [5] U. Ruffer and W. Nultsch, Cell motility and the cytoskeleton 18, 269 (1991)

Primary author: LAROSSI, Taha (LadHyX, Institut Polytechnique de Paris)

Co-authors: AMSELEM, Gabriel (LadHyX, Institut Polytechnique de Paris); JARRAHI, Mojtaba (FAST, Université Paris-Saclay); LAROSSI, Taha (Ecole Polytechnique)

Presenter: LAROSSI, Taha (LadHyX, Institut Polytechnique de Paris)