Type of presentation: Poster

LS-9-P-6036 Micromirror structured illumination for drosophila brain imaging and physiology

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Cellular and neural network dynamics during memory formation remain poorly known. *Drosophila melanogaster* is a unique model to better understand them. Its main advantages are the small size of its brain which gives an optical access to the whole brain after microsurgery, the tractability of global analysis of the whole network and the availability of powerful genetic methods while *Drosophila melanogaster* demonstrate remarkable learning abilities. Genetically encoded fluorescent reporters have given a special place to optical microscopy in drosophila neurobiology research because they allow in vivo analyses of biochemical processes, with good temporal resolution in targeted well-defined cells owing to the binary UAS-Gal4 system. In this field, current optical implementations rely on commercial optical set-up, usually confocal microscope. Integrated analysis of most brain functions, like memory for instance, would benefit from a global 3D monitoring of activity of the neurons involved in the function which is out of reach of current confocal approaches. To take advantage of the potential temporal resolution of the reporter, I have developed a wide-field microscope based on structured illumination by a micromirror matrix technology. This microscope exhibits both high speed imaging and optical sectioning ability. I will present results on mushroom body physiology, a brain area known to be the memory center for olfactory associations, obtained with recently developed genetically encoded reporters, especially the calcium reporter Gcamp6.