**Memory Formation in *Drosophila***

Eric Drier, Tom Tubon, Hong Zhou, Diana Drier, Eugenia Friedman, Jerry Yin*
Depts. of Genetics and Psychiatry, UW-Madison, Madison, WI 53706 USA

*Drosophila* can be taught an olfactory-avoidance behavioral paradigm. Single-trial, repetitive massed, or repetitive spaced training recruit different signal transduction pathways, resulting in memories that have different durations. Spaced training uniquely activates trancription, including the transcription factor dCREB2, and this cascade of gene expression is needed for long-term memory. This universal requirement for acute gene expression around the time of training is independent of the type of behavior or animal species.

How do neurons strengthen specific synapses when cell-wide processes like transcription and translation occur? The synaptic tag has been hypothesized to mark recently active synapses, and allow them to exclusively utilize macromolecules sent ubiquitously. We are interested in the molecular/cellular properties of the tagging machinery. Our perspective is evolutionary—tagging is a sufficently complex process, making it is unlikely that neurons evolved a molecular solution *de novo*. Instead, they are more likely to re-deploy solutions that other "simpler" cell types have evolved to solve similar cell biological problems. The atypical protein kinase C protein is part of an evolutionarily conserved machinery used to exquisitely mark intracellular location. We will present recent data supporting the role of atypical PKC in the process of tagging, and argue that it is an important player in the process of marking recently active synapses.

Drier, E. A., Cowan, M., Tello, M. K., Wu, P., Blace, N., Sacktor, T. C. and Yin, J. C. P. 2002. Memory formation and enhancement by atypical PKM activity in *Drosophila melanogaster*. Nat. Neurosci : 316-324.