FlyBrain Neurogenomics: Hunting for Memory Genes and Circuits

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Summary. Thousands of fly genes operate in the brain circuits, each at a different time and space, controlling complex behavior. While Gal4/UAS reporter system and molecular tagging techniques have led a useful model of how gene products work, the expression patterns of single gene and lacking enough resolution to visualize brain circuits are limited in giving us a comprehensive picture of the brain's higher functions such as learning and memory. The complexity inherent to simultaneously considering thousands of proteins to formulate integrative biological questions is urging for the development of neuroimage databases to integrate individual gene expression maps into an atlas. We aim to generate the first 3D brain neurogenomics database for storage, retrieval and comparison of gene expression patterns in the *Drosophila* adult brain. We reason that if all connections among neurons could be mapped, together with genes expressed in these neurons at different times could be visualized in the whole brain, the resulting spatial and temporal circuit diagrams should reveal mechanisms underlying the brain's operation. Our long-term goal is to apply *Drosophila* brain neurogenomics data for understanding how the brain works and developing new tools and drugs for human brain disease therapy. Currently, we focus on answering where and how the various gene products collaborate when the memory is formed, retrieved and washed away.