Identification of neural circuits required for spontaneous behavioral variability

Sathish K. Raja, Björn Brembs
Institut für Biologie - Neurobiologie, Freie Universität Berlin

Abstract

In the absence of external stimuli, brains are capable of initiating spontaneous behaviors. Candidate lines expressing tetanus toxin light chain in various regions of the fly brain using the Gal4-UAS system were screened for a decreased elicitation of yaw torque spikes (the equivalent of body-saccades in free flight) did detection of yaw torque spikes (the equivalent of body-saccades in free flight) did not show any obvious evidence of oscillatory behaviors.

4. Quantifying the randomness in candidate line ISIs

5. True spike frequency

6. No oscillatory components in spontaneous fly turning behavior

7. Fano Factor analysis of torque spike variability

The Fano factor (FF) is quantified by the ratio of the variance to mean spike count. The FF approaches 1 if the data is poisson distributed. The spike count is collected in 50s windows over the entire trace and the FF is calculated for each genetic line.

Fig. 2 A - Average slope of S-Map results from candidate fly lines expressing tetanus toxin light chain in various regions of the fly brain. The slope of the S-Map is calculated by the equation: S-Map slope = 2 * (mean ISI) / (SD ISI) * (SD ISI / mean ISI).

Fig. 3 Standard deviation from randomness (0 as ideal randomness) using Geometric mean fusion. Yaw turning behavior of tethered flies was recorded with the wing-brain, by expressing tetanus toxin light chain (TNT-E) to prevent synaptic vesicle fusion. In the absence of external stimuli, brains are capable of initiating spontaneous behaviors. Candidate lines expressing mainly in the central complex temporally constant, preventing the fly from perceiving any stimuli which might elicit turning behavior. Candidate lines expressing mainly in the central complex underlying circuits and the neurobiological mechanisms for generating spontaneous behaviors.

Fig. 4 Deviation From Randomness (SDR) in candidate line ISIs. The SDR is calculated by the equation: SDR = (Variance / Mean) - 1.

Fig. 5 Time of flight (min) and mean flight duration. The time of flight and mean flight duration were calculated for each genetic line expressing the tetanus toxin light chain.