Circuits that encode and guide alcohol associated preference

Kristin M. Scaplen¹, Mustafa Talay¹, Sarah Salamon⁴, Kevin Nuñez², Amanda G. Waterman¹, Sydney Gang³, Sophia L. Song¹, Gilad Barnea¹, Karla R. Kaun¹
¹Dept of Neuroscience, ²Dept of Molecular Pharmacology and Physiology, ³Dept of Biochemistry, Brown University, Providence RI, U.S.A., ⁴University of Cologne, Cologne, Germany

**Drosophila** neural circuits that mediate reward learning are similar to other species.

- Functional circuits between dopamine neurons and glutamate, GABA and acetylcholine neurons underlie responses to reward and punishment (Scaplen & Kaun 2016).
- The *Drosophila* Mushroom Body (MB), a central brain associative structure, is densely innervated and compartmentalized by dopaminergic input and glutamatergic, GABAergic and cholinergic output neurons (Aso et al. 2014).

**Drosophila** exhibit enduring preference for cues associated with alcohol intoxication.

- Flies will withstand 120V shock to reach alcohol associated cues (Kaun et al. 2011).
- Alcohol reward memories last up to 7 days and require the MB and dopamine (Kaun et al. 2011).

**Expression of alcohol reward requires a remarkably complex multi level circuit of dopaminergic, glutamatergic, and cholinergic neurons, which converges within and outside the MB.**

**Conclusions**

- Alcohol reward memory require population level dopamine modulation that increases with prolonged alcohol exposure.
- The expression of memories requires two discrete microcircuits within the vertical and horizontal lobes.
- Microcircuits converge on a glutamate neuron important for consolidation and dorsal layers of the Fan Shaped Body (FSB).
- Within identified reward circuits that span across brain regions we can now layer molecular questions about how receptors change within this circuit with experience.