PhD position in the evolution of neural circuit structure and function
Benton Laboratory

How do new neuronal circuits evolve?

We approach this fascinating question in the olfactory system of *Drosophila*. Olfactory pathways are one of the most dynamically evolving parts of the nervous system: animals frequently acquire (and discard) olfactory receptors, circuits and odour-evoked behaviours with the ever-changing landscape of stimuli in their environment. The evolutionary flexibility of olfactory systems is reflected in their modular organisation: in insects (as in vertebrates), most individual olfactory sensory neurons (OSNs) express just one olfactory receptor gene, and the axons of OSNs expressing the same receptor converge on discrete regions of neuropil (glomeruli) within the primary olfactory centre, where they synapse with second-order neurons. The numbers of olfactory receptors vary widely across species, with concordant diversity in the number and organisation of OSNs and glomeruli in the brain.

Using developmental genetics, single-cell sequencing and circuit tracing methods in the peripheral olfactory system of *Drosophila melanogaster* and closely-related drosophilid cousins, our lab is studying: (i) the mechanisms and evolution of olfactory receptors' singular expression properties, (ii) how novel populations of OSNs arise through changes in patterns of neurogenesis and developmental programmed cell death, and (iii) how OSN populations are segregated to distinct glomeruli to form unique sensory channels in the brain, and how these guidance mechanisms are modified to create new glomeruli. The mechanisms and molecules we characterise are likely to be relevant for understanding circuit formation and evolution in other brain regions and species.

The specific PhD project will be developed together with the successful candidate in one of these topics, depending upon their interests and expertise.

References

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