Problem Statement
• A major goal in circuit neuroscience: discovering how behavior is mediated through information processing in the neural circuits of the brain.
• Knowledge about neuron connectivity is essential for understanding how this information is processed and transmitted.
• Connections between neurons can only occur, if the respective terminal branchings of nerve fibers (arborizations) overlap.
• Hypothesis formation about neural connectivity based on arborization overlaps using three dimensional visualization is difficult when multiple neurons are involved, since the displayed objects occlude each other.

Motivation
A new form of connectivity representation was desired. This led Yu to the creation of a two dimensional diagram of neural projections.

Goal of the Thesis
• Replicate the features of Yu’s diagram in an automatically generated interactive graph
• Provide a new and intuitive way of exploring neuron data
• Provide means for easier connectivity hypothesis formation
• Enable fast and automatic generation of connectivity diagrams for presentation purposes

Limitations in Other Systems
■ Exploration of hierarchical networks
■ Visualization of multiple attributes
■ Visualization of flows and paths
■ Incorporation of spatial constraints

Spatial Constraints
neuroMap’s anatomical layout assigns neuropils to 19 compartments that represent actual brain regions. The regions are arranged to comply with the scientists’ mental model of Drosophila’s brain. This supports the intuitive understanding of the graph structure and the contained signal flows.

Visualization of Flows and Paths
Highlighting reacts differently for each type of element. Highlighting an overlap shows all associated overlaps and elements in the graph.

Exploration
Interactive neuropil merging enables the scientists to adapt the structure of the graph to comply with their current re-search focus. Attributes of merged elements are aggregated.

Context sensitive queries enable the extension of the graph structure with potentially connected neurons directly from within neuroMap.

Conclusion
• Created and evaluated in collaborations with a group of neuroscientists at the Institute of Molecular Pathology (IMP).
• Features of Yu’s drawing successfully replicated and extended.
• Providing an abstract overview of complex neuroanatomical data.
• Already actively deployed by our collaborators.