

Circuit Connectome

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Abstract

This report analyzes a circuit’s connectome, *i.e.* the network like structure of neuron-to-neuron connectivity.

Introduction

Connectome of a brain circuit is the complete description of its neuron-to-neuron connectivity. While at the local level a neuron’s connections determine its activity, at the circuit level the connectome determines the circuit’s computational capability.

Here we analyze if a circuit’s connectome follows the general principles of connectivity developed in [Reimann *et. al.*](#), and has biologically realistic connectivity between neurons.

A synapse between two neurons develops from an apposition between their axonal and dendritic arbors. The shapes of these trees are determined by the morphological types (mtypes) of the pre/post synaptic neurons. Thus we will analyze the connectivity of neurons of a specified pre-synaptic mtype to neurons of a specified post-synaptic mtype. We will talk of these two pre and post synaptic populations as forming a mtype-to-mtype pathway.

¹This report was written using [DMT](#).

Methods

Measurements

- **Connection Probability:** What is the probability that a cell from a pre-synaptic population is connected to a cell from a post-synaptic population? The pre and post synaptic populations are specified by their mtypes.
- **Synapse Count:** Number of synapses mediating connections. The pre and post synaptic populations are specified by their mtypes.
- **Indegree:** Number of afferent / in-coming connections at a neuron of a given mtype.
- **Number Afferent Connections:** How many connections from neurons of a given pre-synaptic mtype to a neuron of a give post-synaptic mtype.

Results

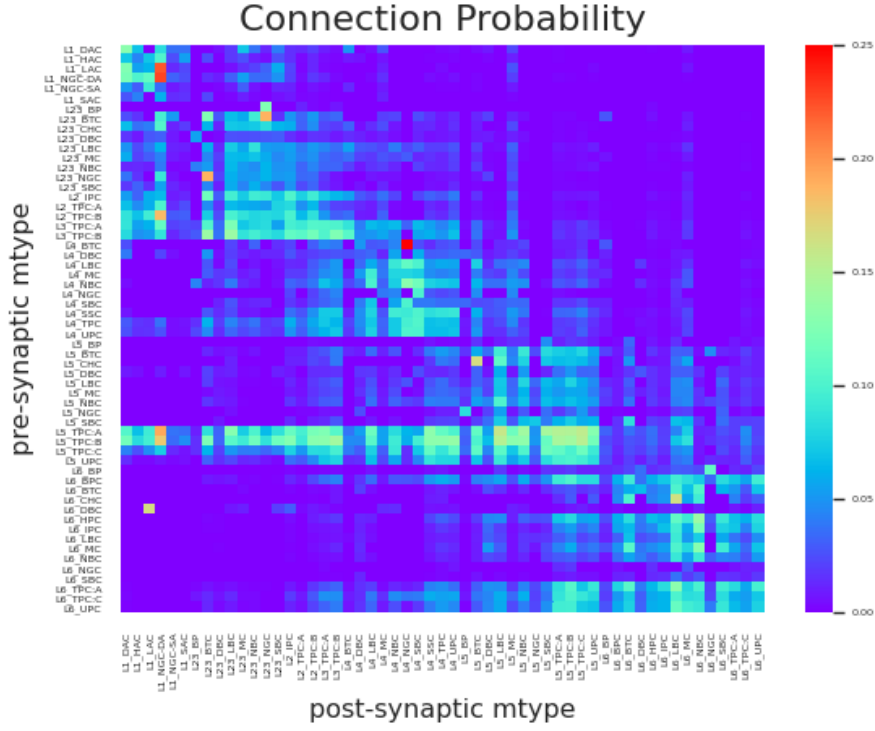


Figure 1: Probability that a neuron from a pre-synaptic population is connected to a neuron from a post-synaptic population. The populations are specified by mtype.

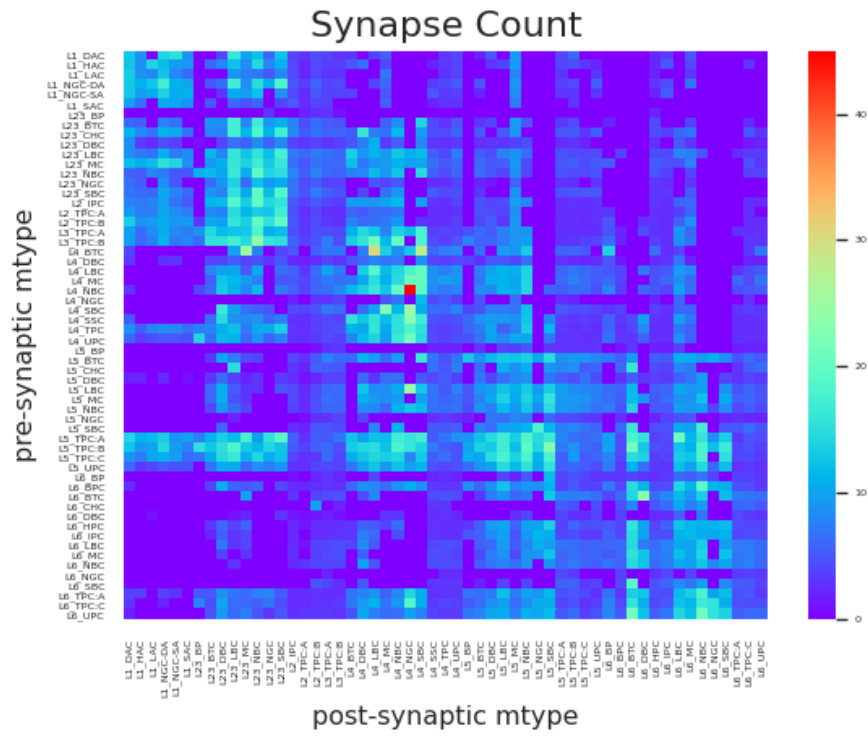


Figure 2: Mean (expected) number of synapses mediating connections in a mtype- \rightarrow mtype pathway.

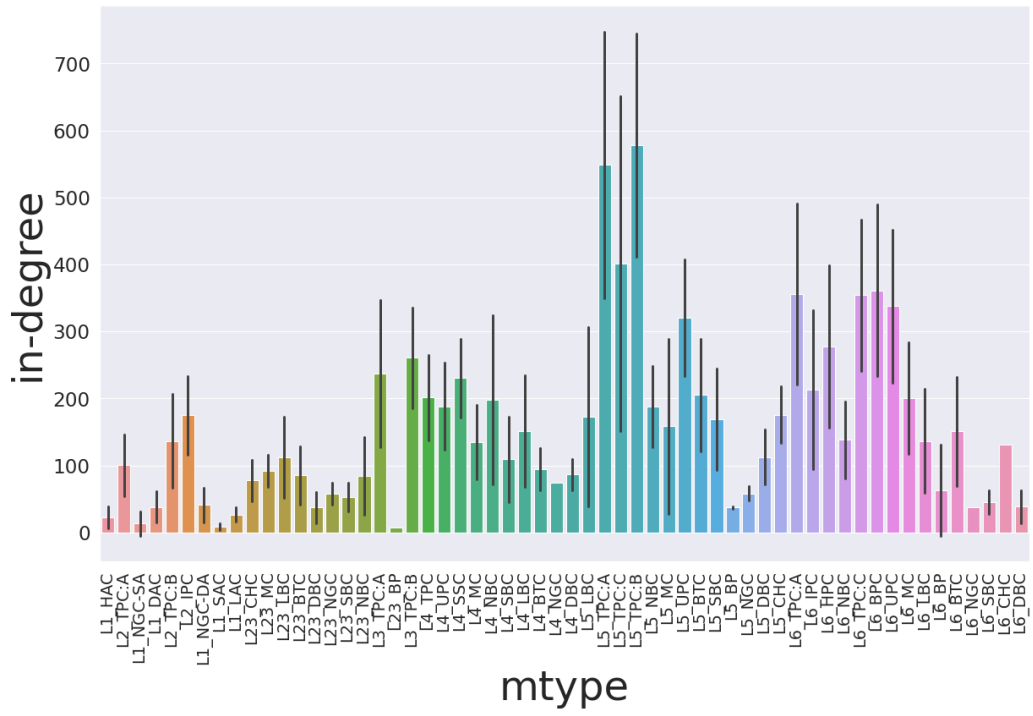


Figure 3: Total number of afferent connections arriving at a neuron.

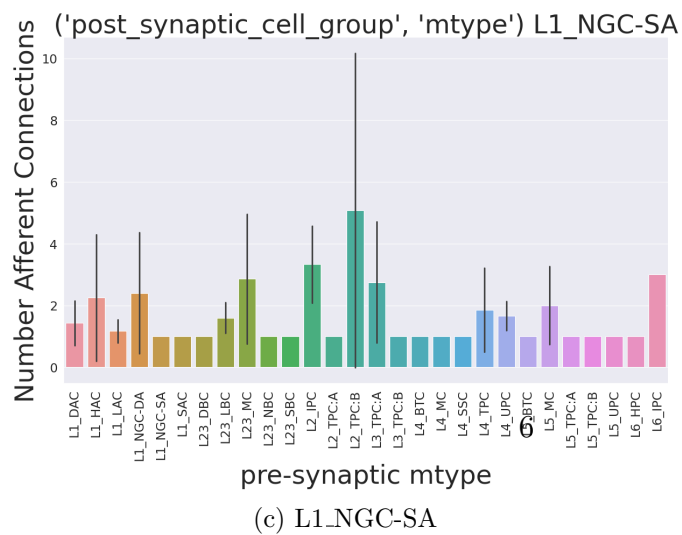
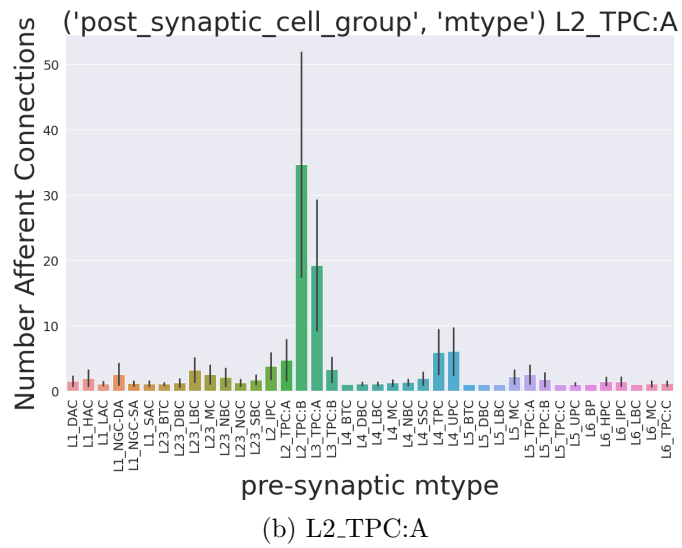
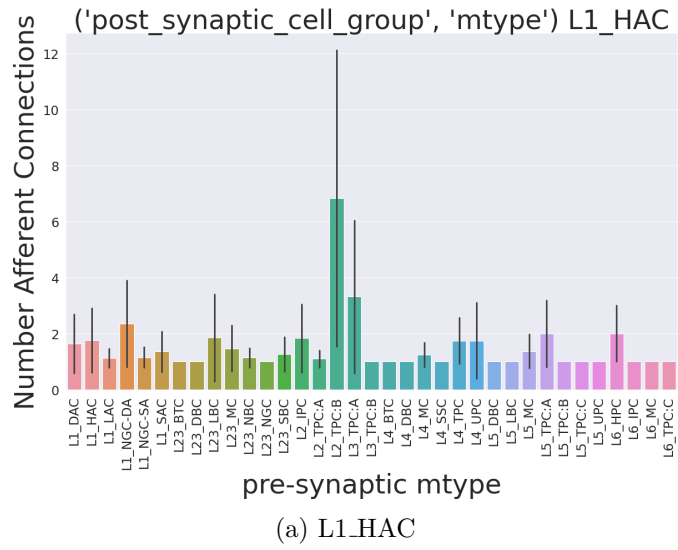


Figure 4: Number of connections arriving at a neuron.

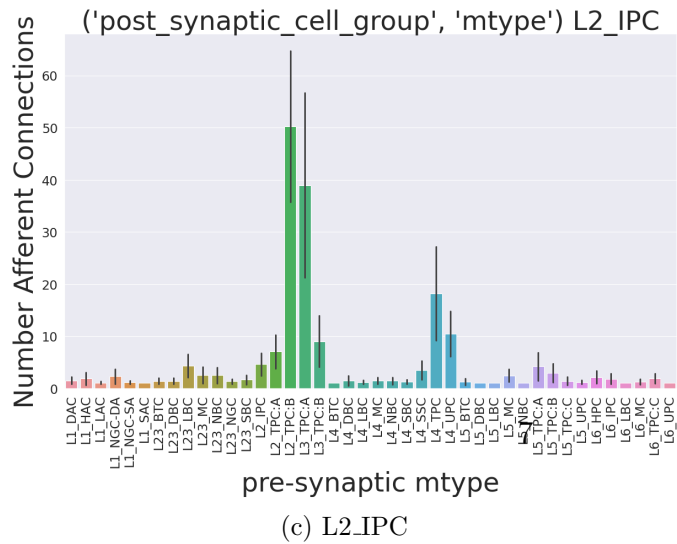
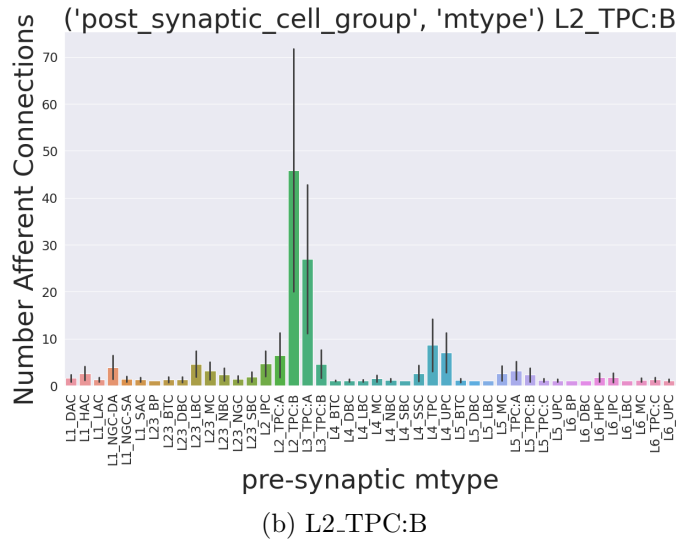
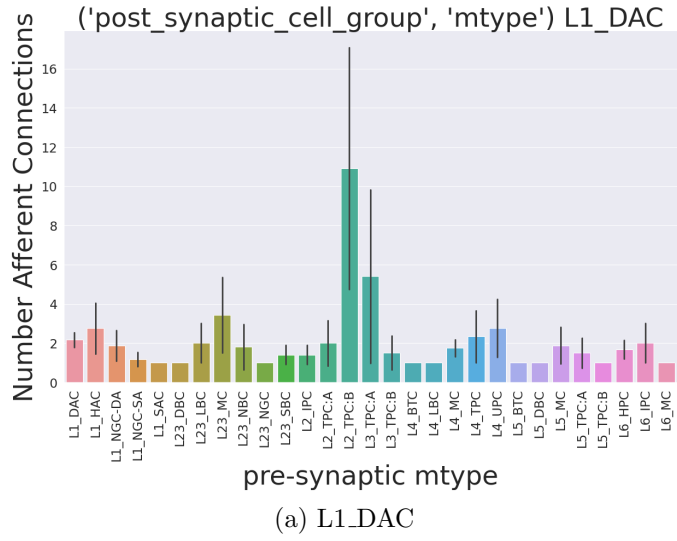


Figure 5: Number of connections arriving at a neuron.

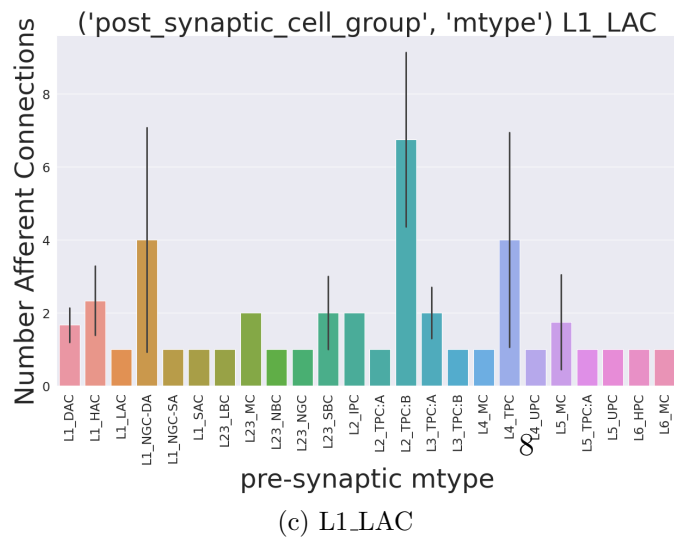
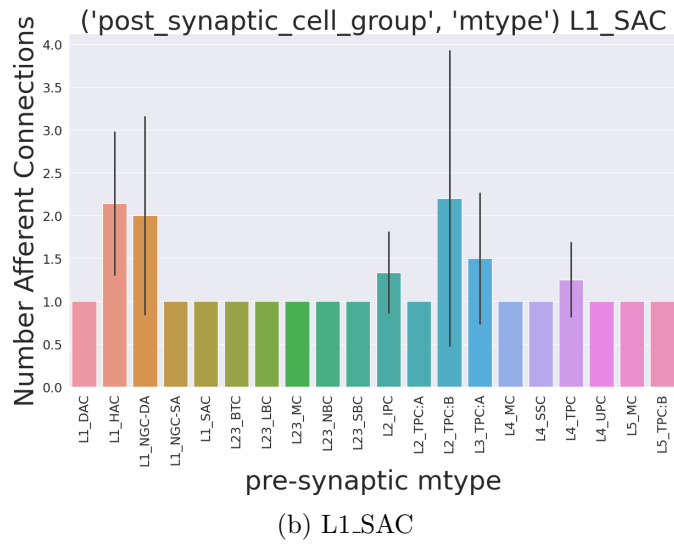
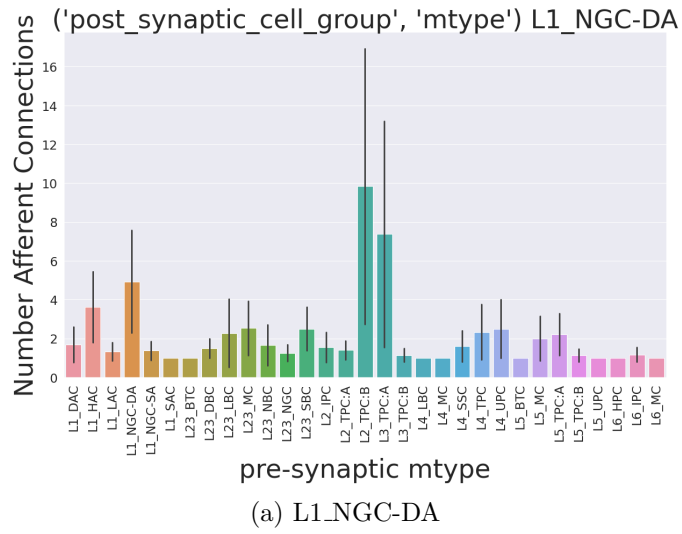


Figure 6: Number of connections arriving at a neuron.

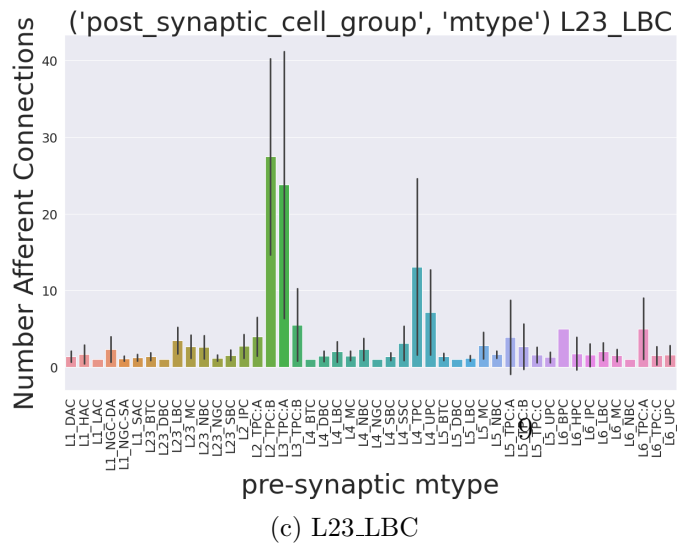
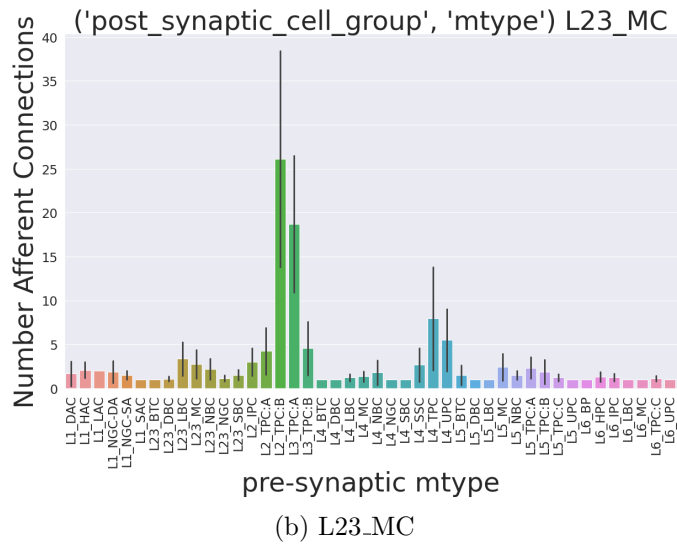
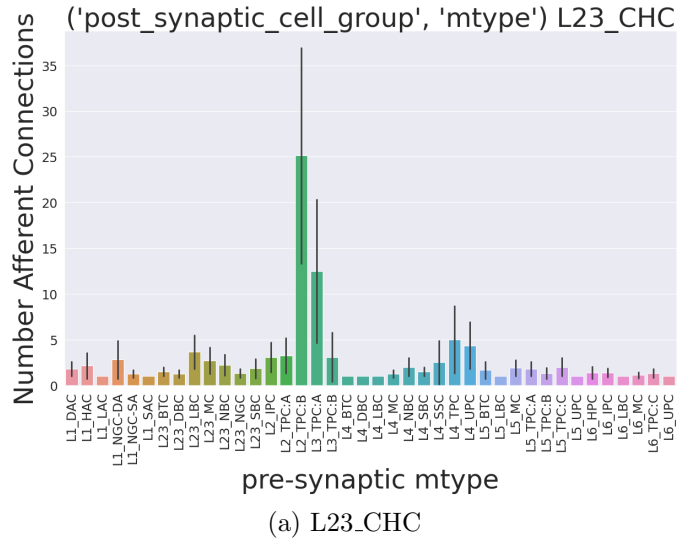


Figure 7: Number of connections arriving at a neuron.

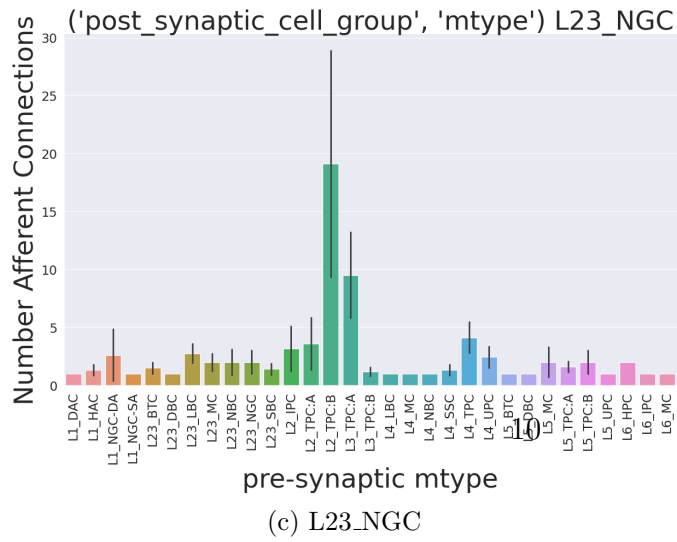
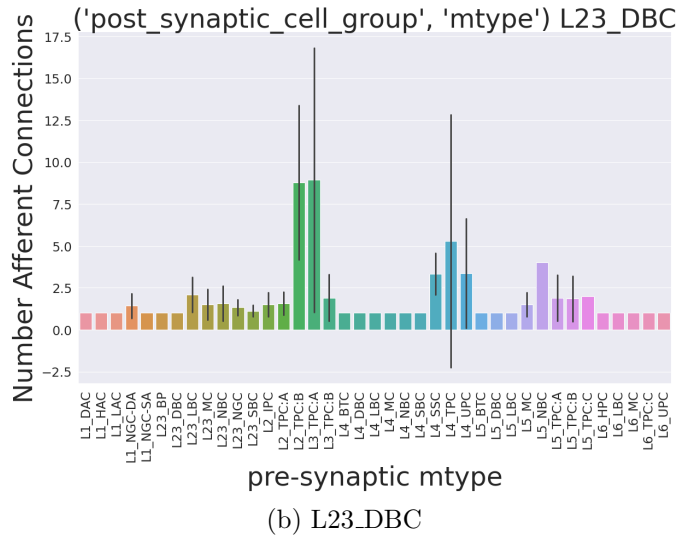
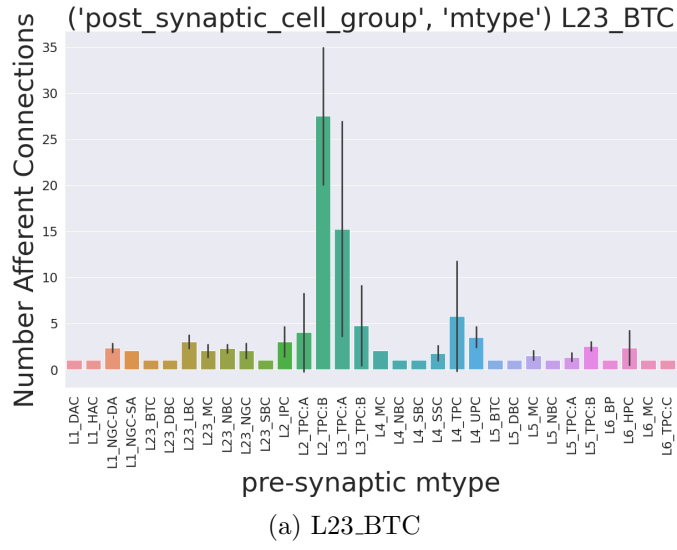


Figure 8: Number of connections arriving at a neuron.

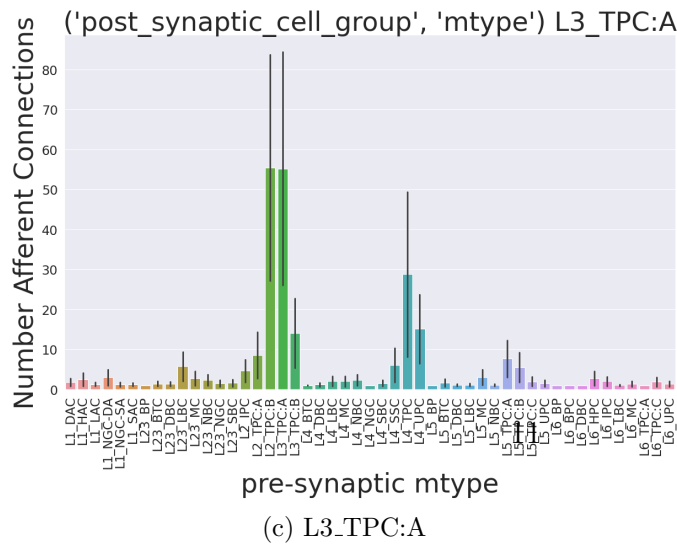
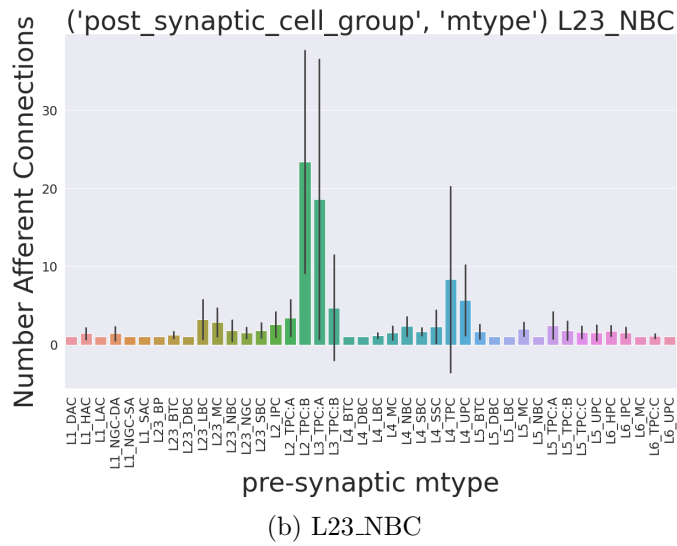
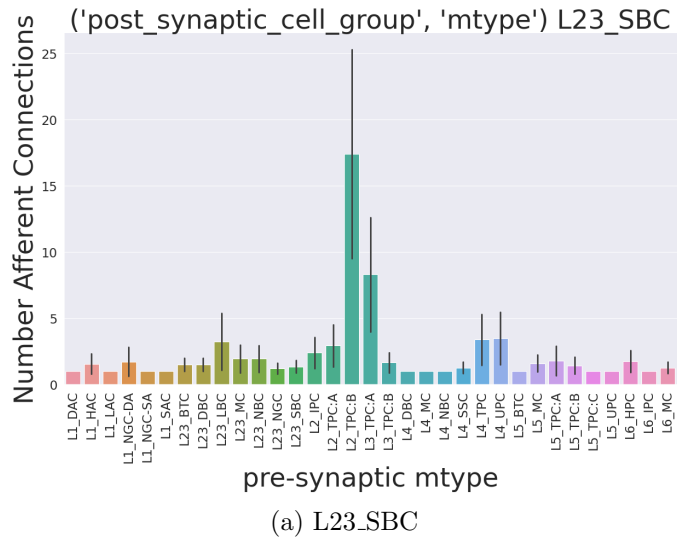


Figure 9: Number of connections arriving at a neuron.

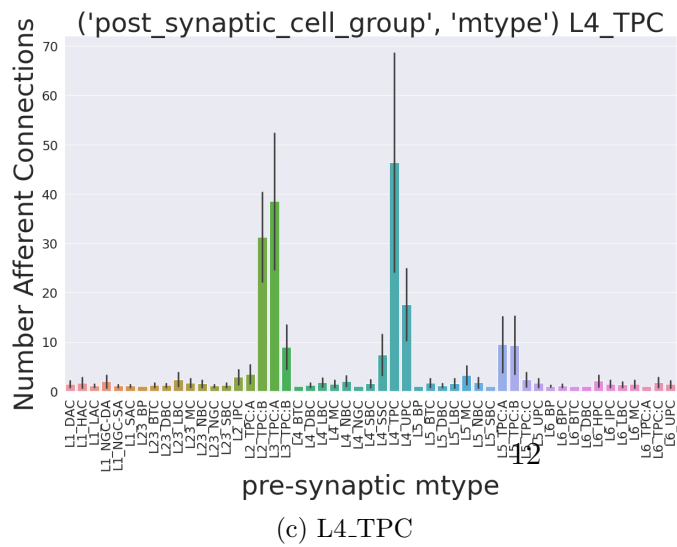
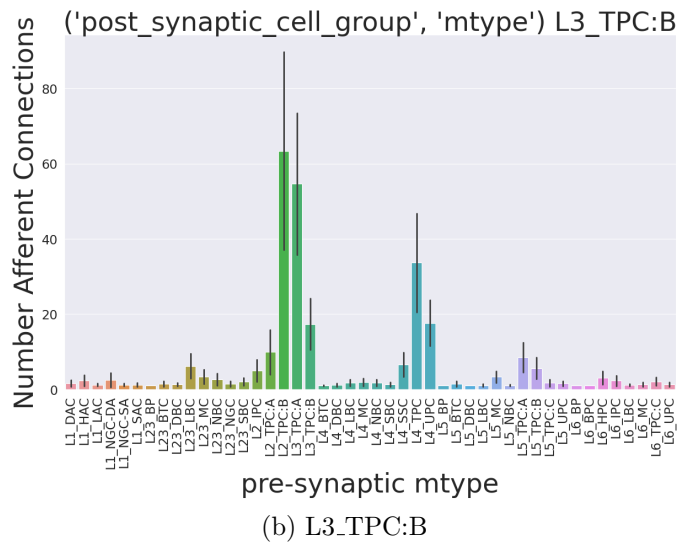
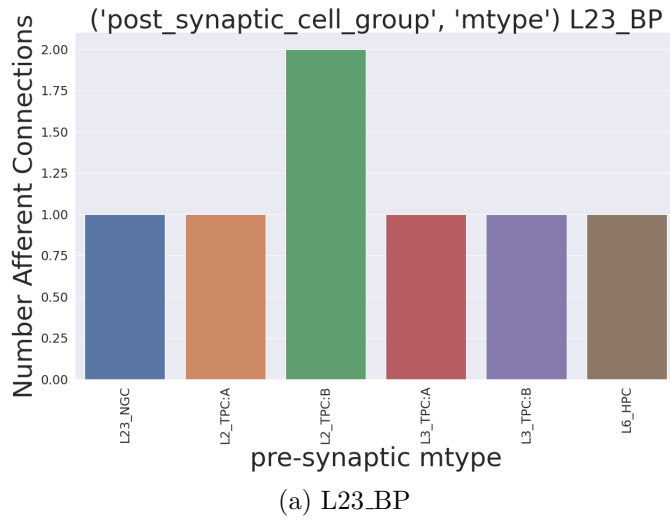


Figure 10: Number of connections arriving at a neuron.

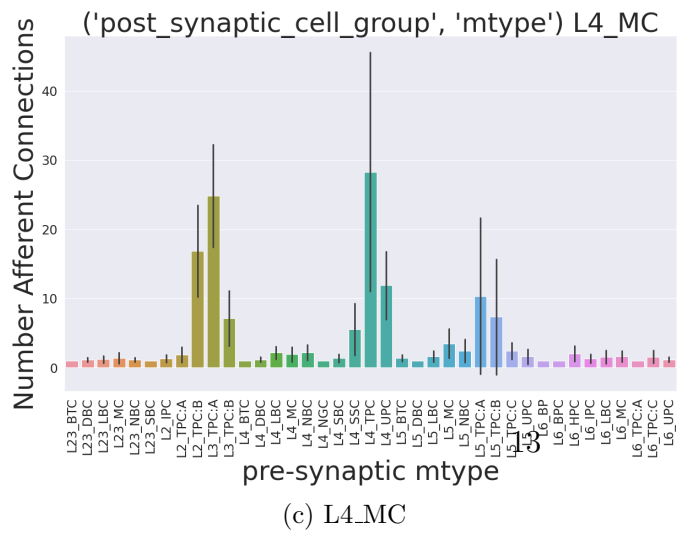
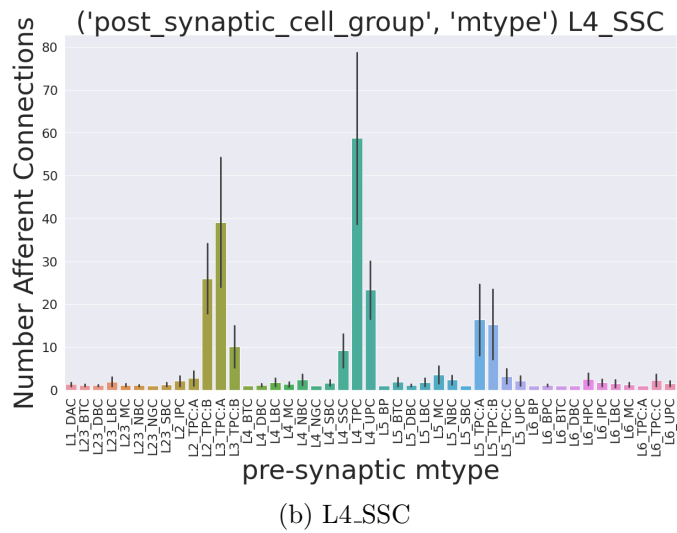
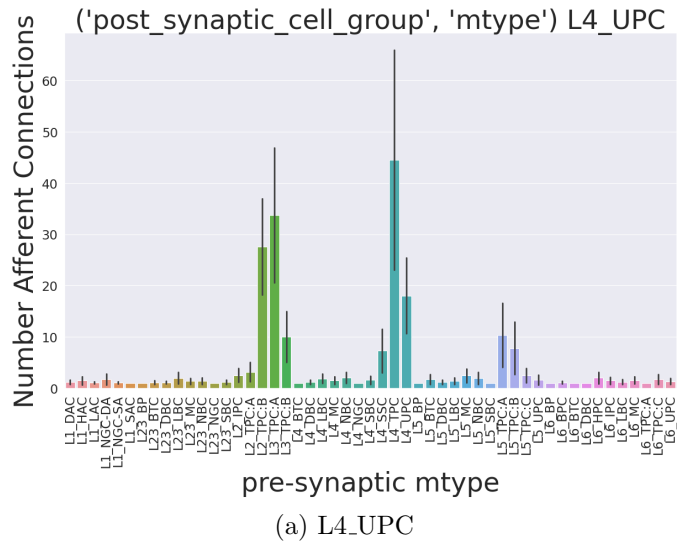


Figure 11: Number of connections arriving at a neuron.

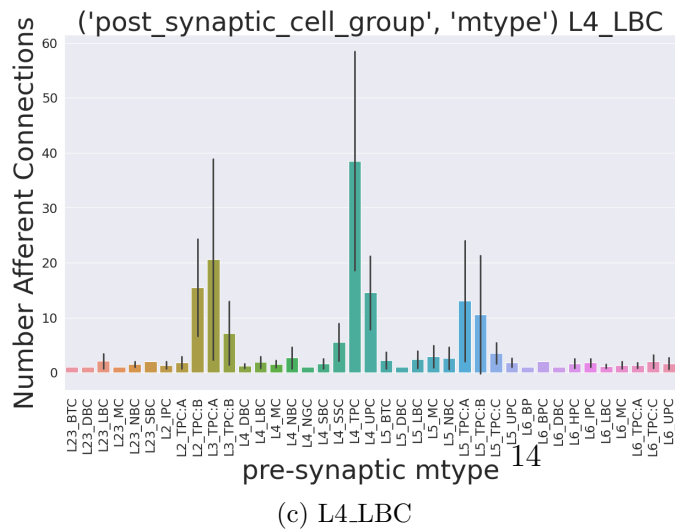
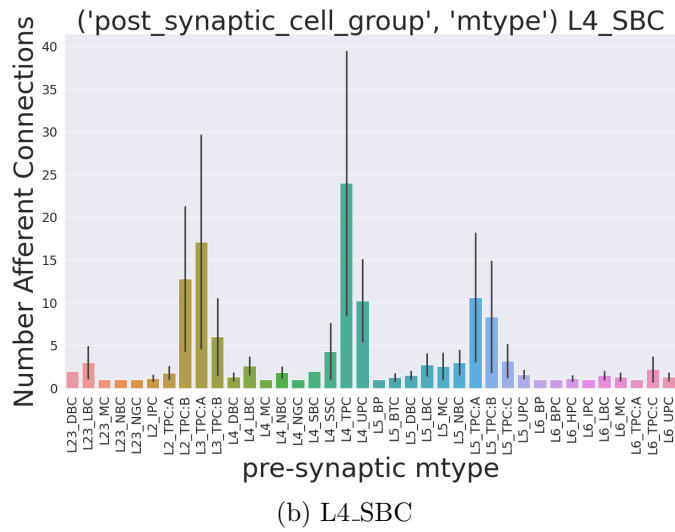
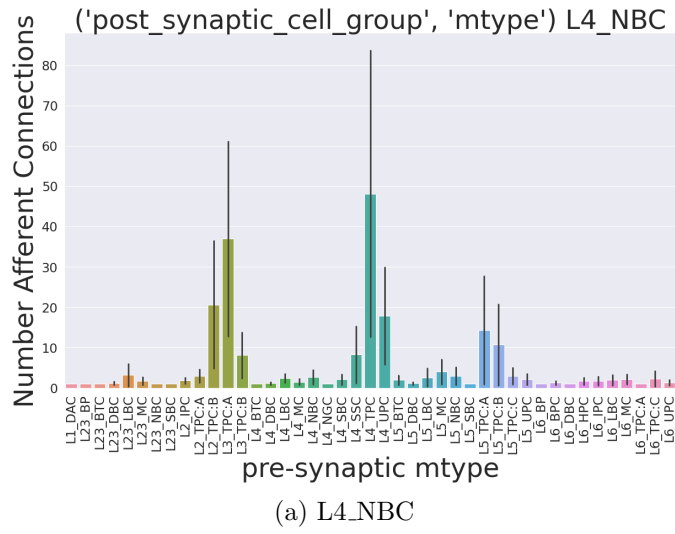
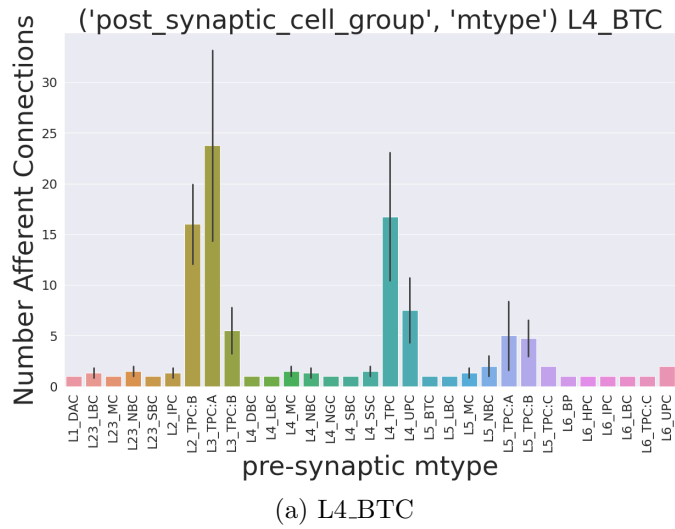
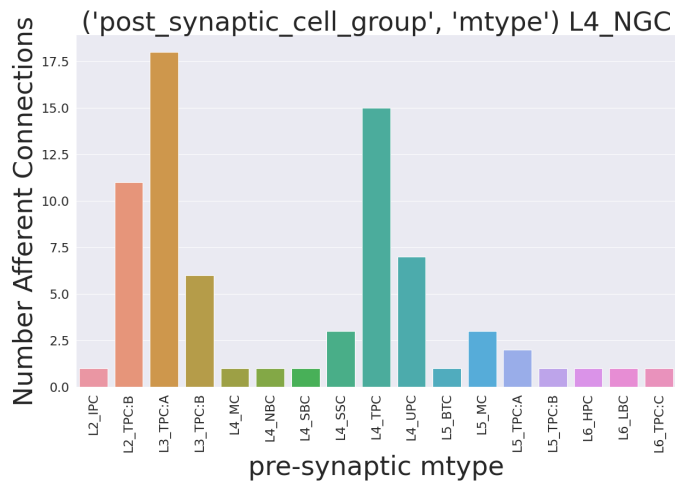


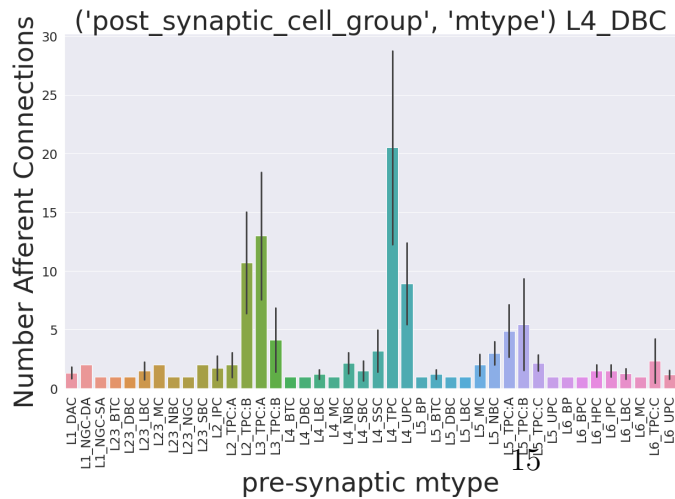
Figure 12: Number of connections arriving at a neuron.



(a) L4.BTC



(b) L4.NGC



(c) L4.DBC

Figure 13: Number of connections arriving at a neuron.

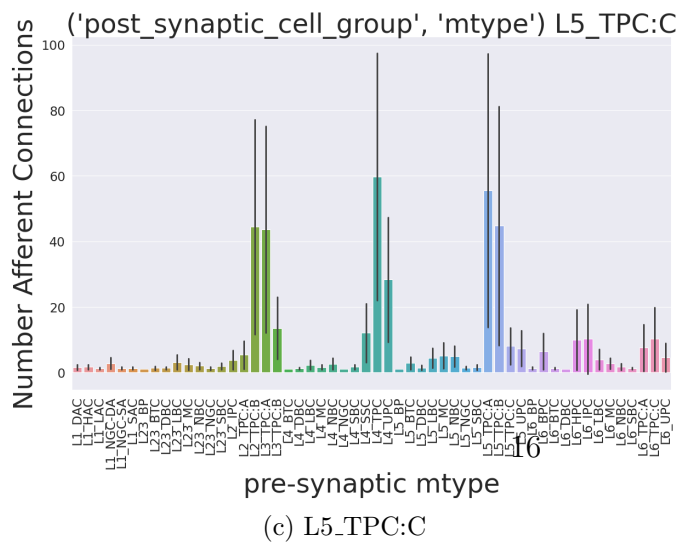
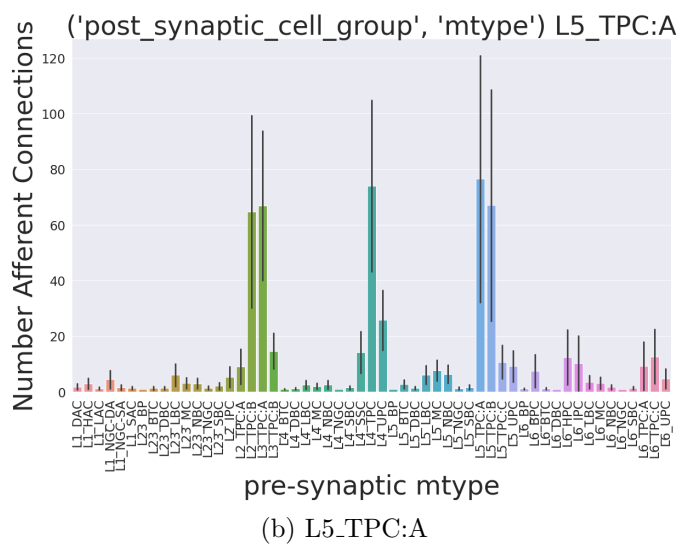
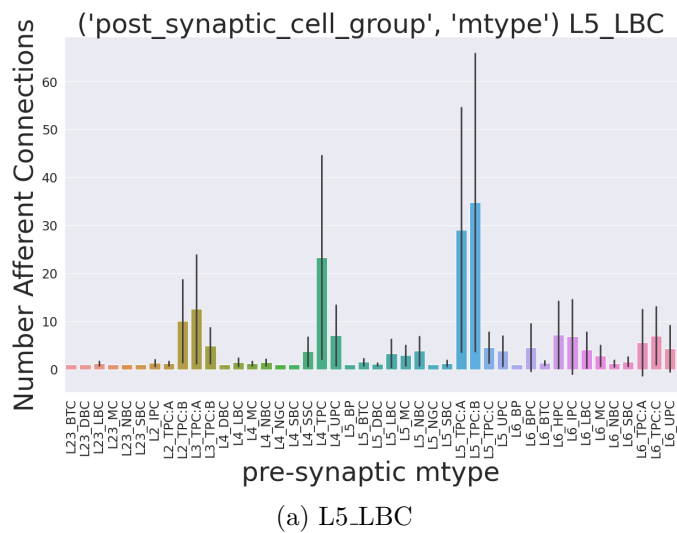
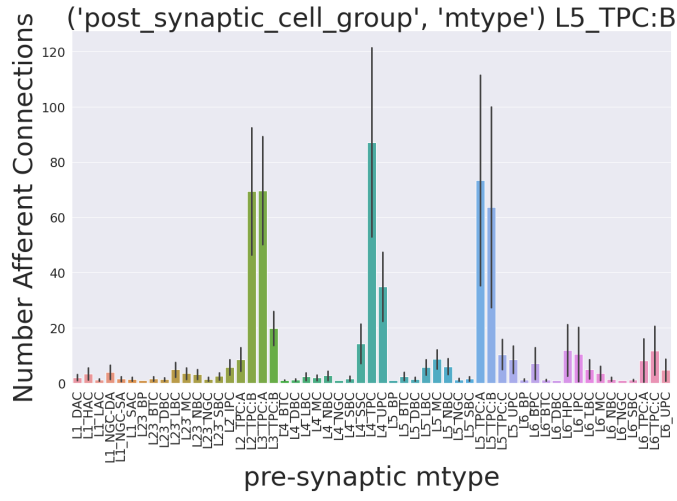
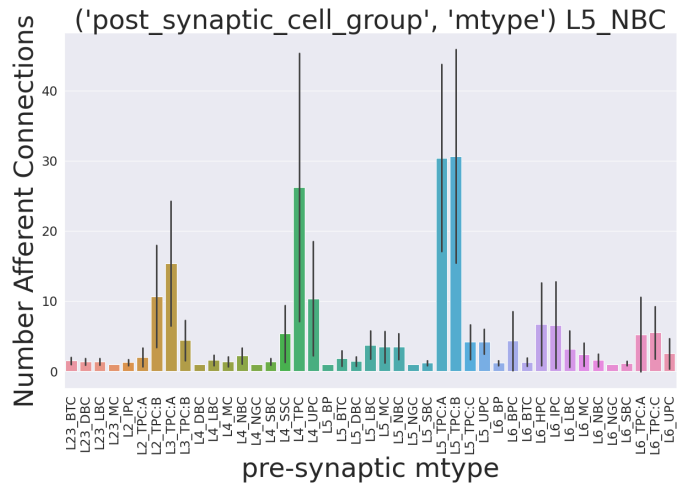


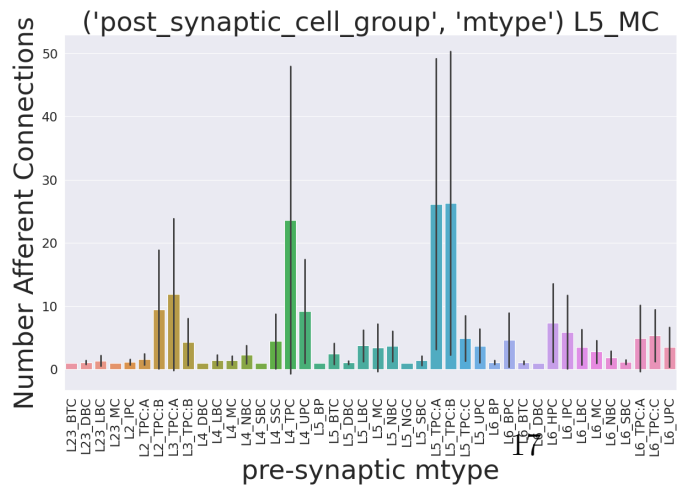
Figure 14: Number of connections arriving at a neuron.



(a) L5_TPC:B



(b) L5_NBC



(c) L5_MC

Figure 15: Number of connections arriving at a neuron.

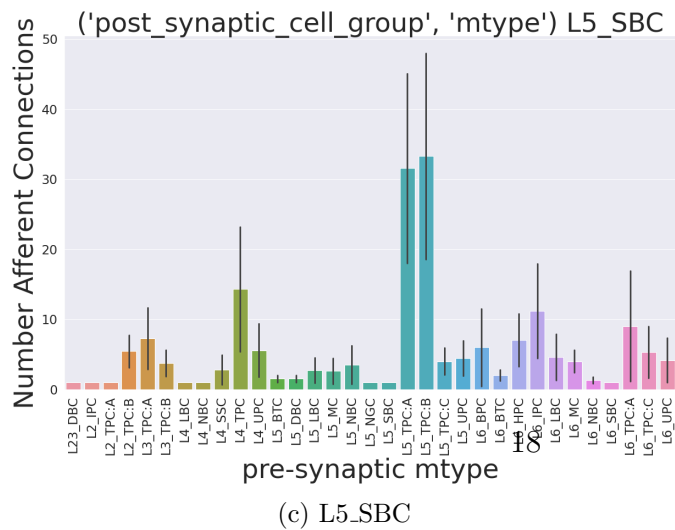
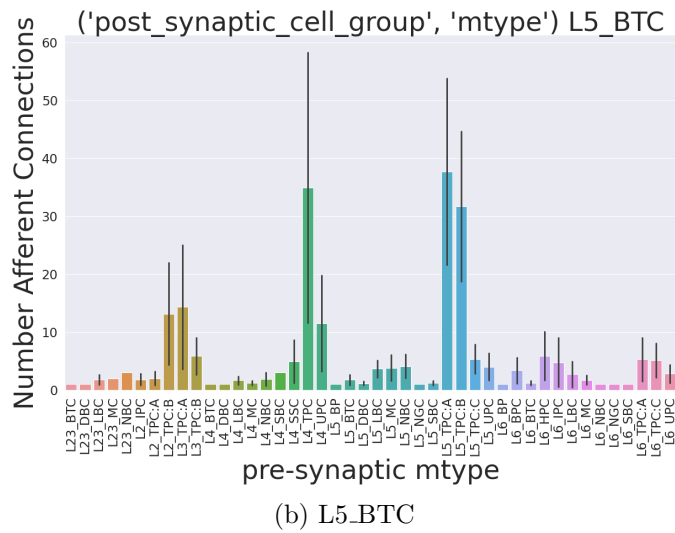
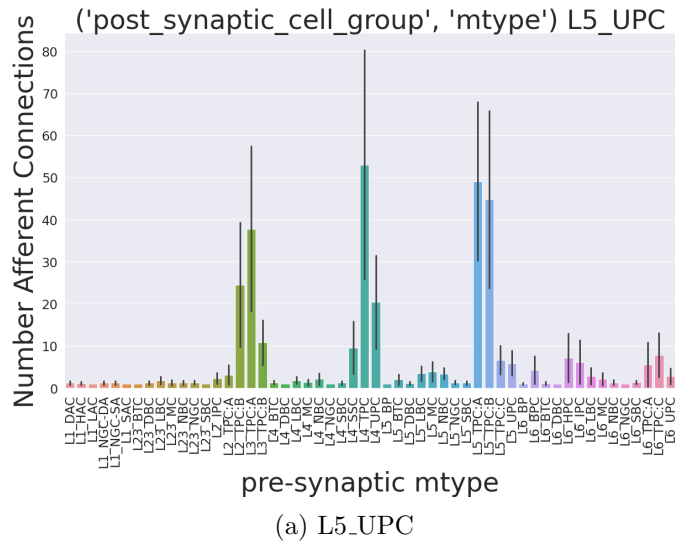


Figure 16: Number of connections arriving at a neuron.

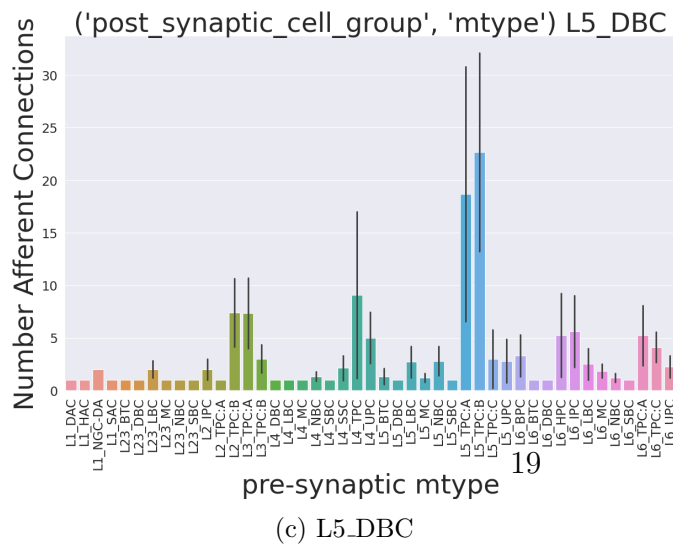
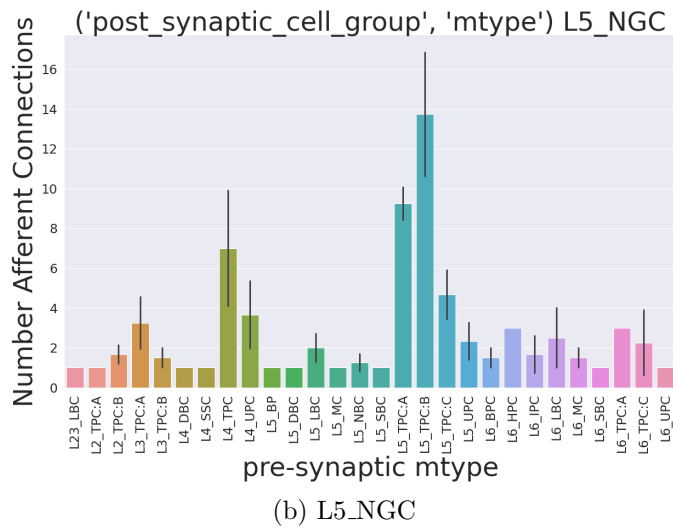
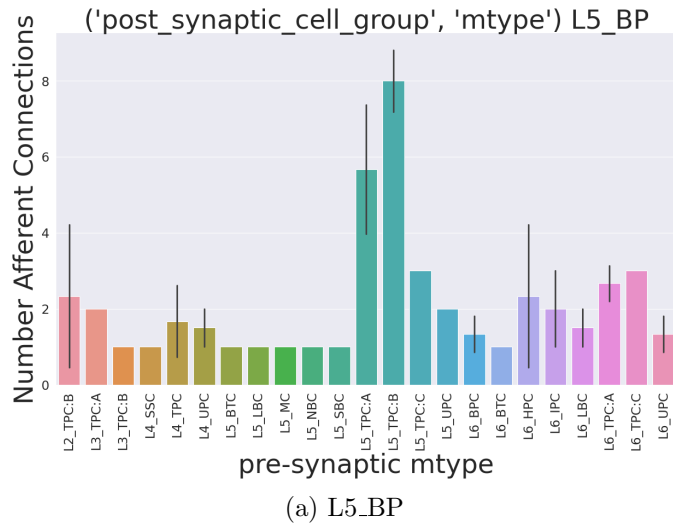


Figure 17: Number of connections arriving at a neuron.

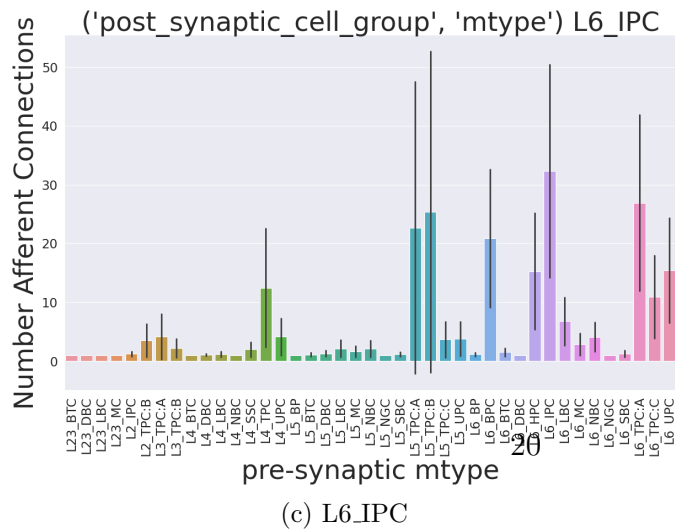
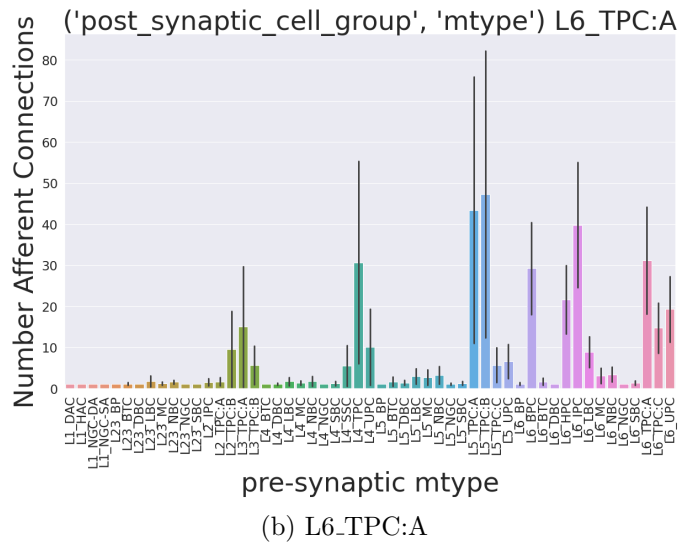
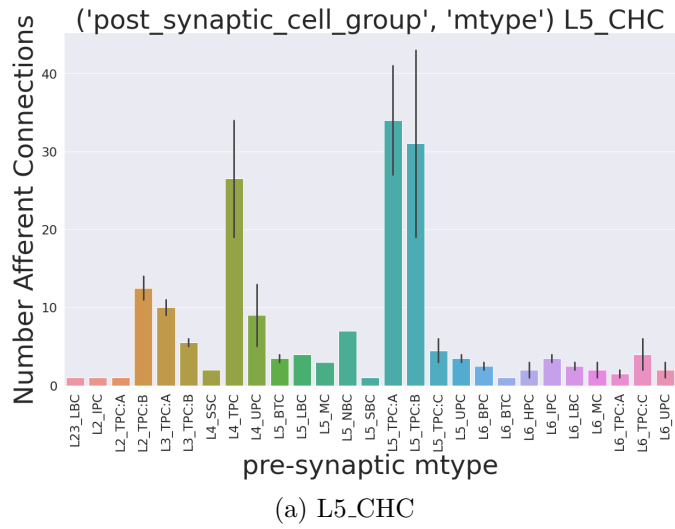


Figure 18: Number of connections arriving at a neuron.

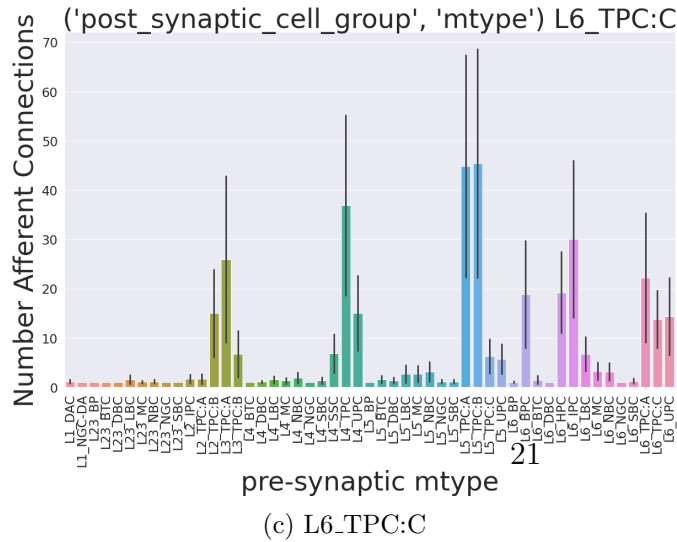
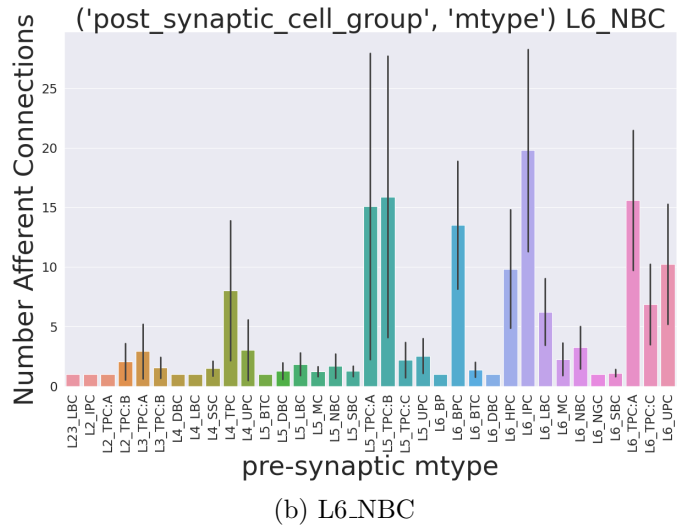
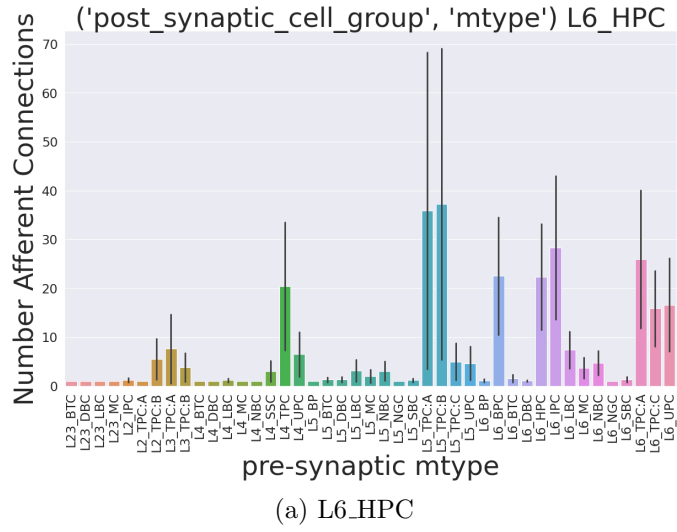


Figure 19: Number of connections arriving at a neuron.

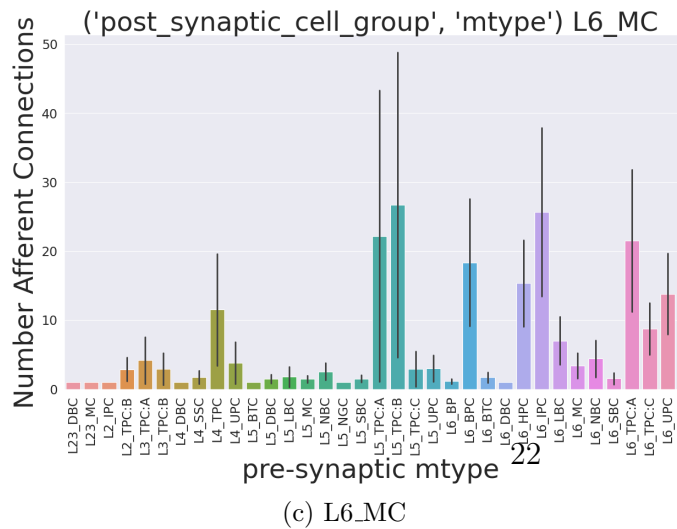
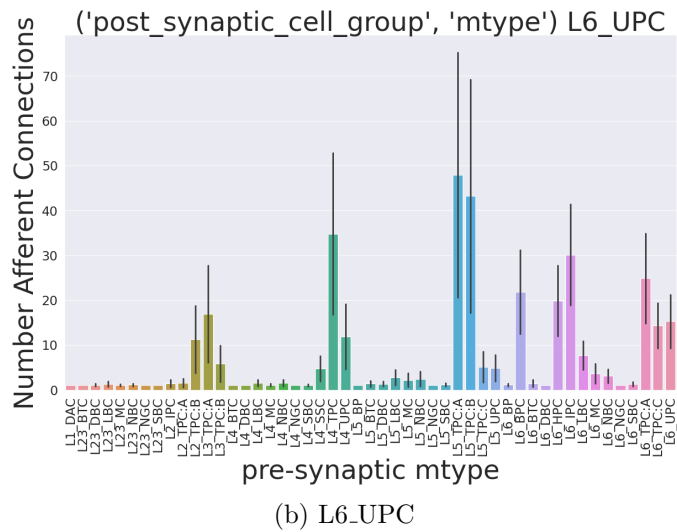
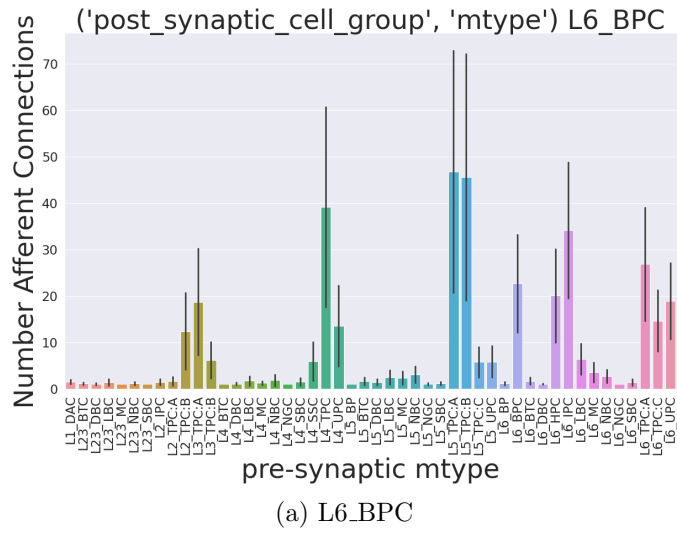


Figure 20: Number of connections arriving at a neuron.

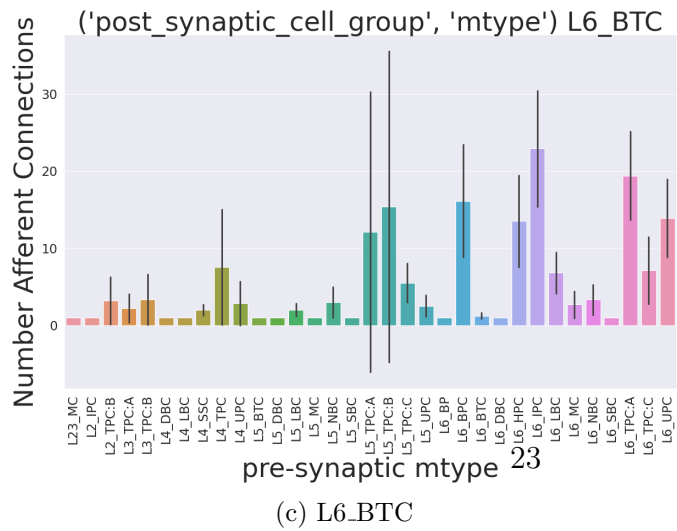
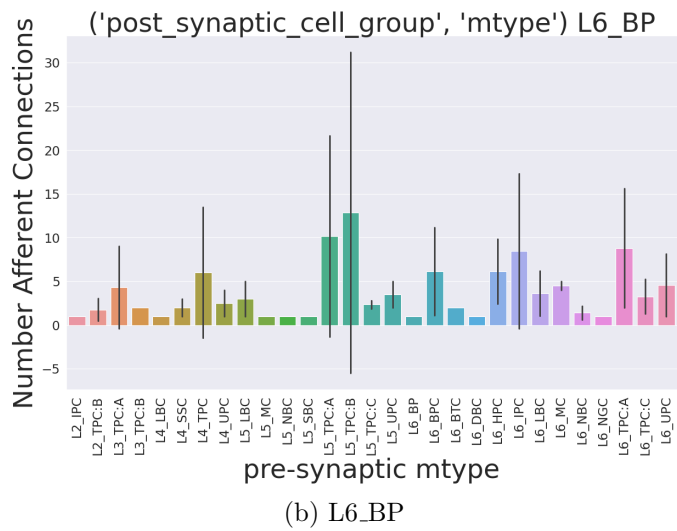
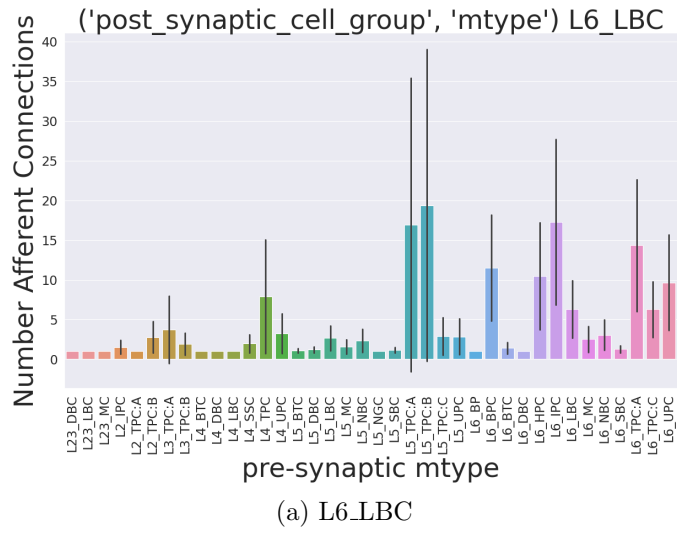


Figure 21: Number of connections arriving at a neuron.

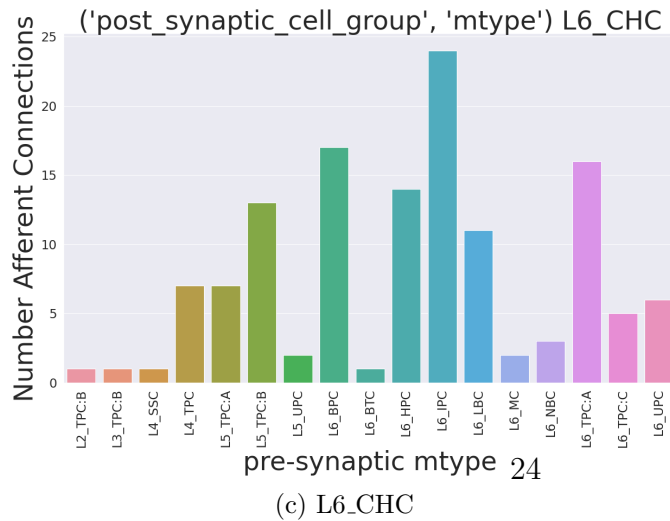
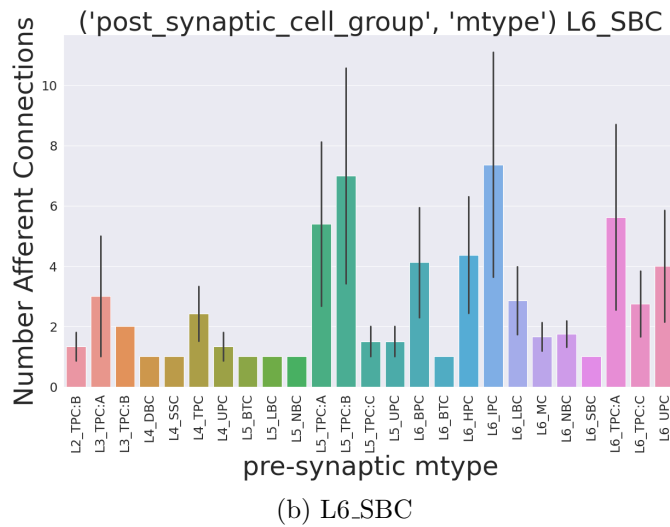
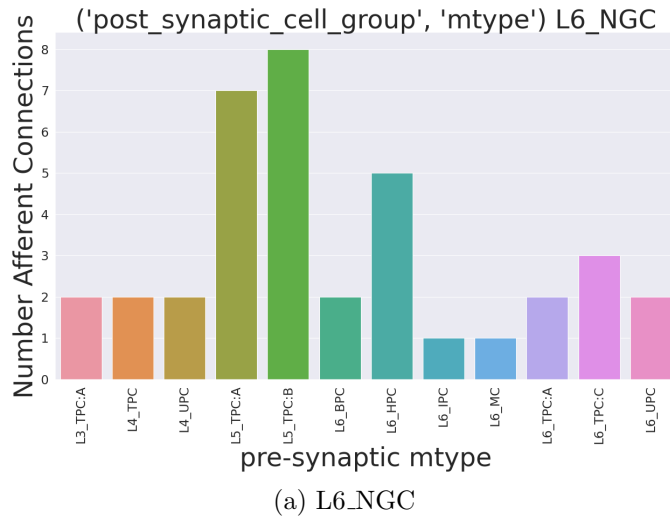


Figure 22: Number of connections arriving at a neuron.

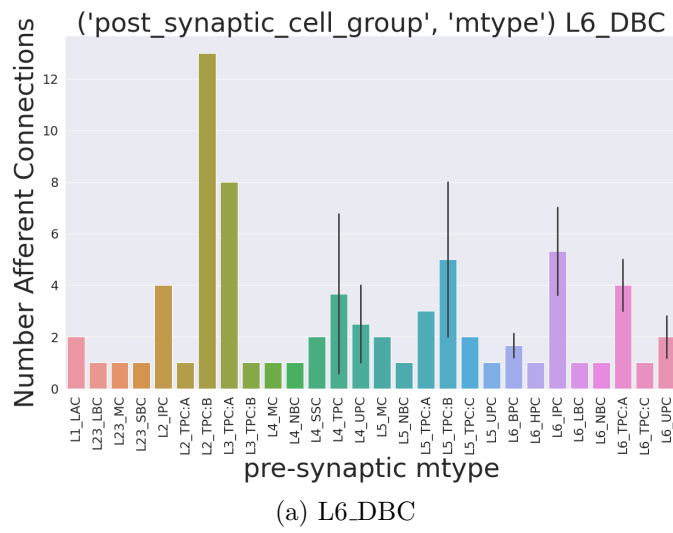


Figure 23: Number of connections arriving at a neuron.