STATISTICAL ANALYSIS OF DENDRITIC BRANCHING IN HIPPOCAMPAL NEURONS

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The analysis of neuron morphology is geared toward increasing our understanding of dendritic branching and developing mechanisms. Neurological disorders such as autism and Retts syndrome are associated with disrupted or altered branching patterns. Understanding which factors affect branching and how they do so is the first step toward developing drugs that can target these disruptions directly.

In a series of experiments, intra-cellular and extra-cellular factors are manipulated and their effects on dendritic branching recorded. The data consist of the number of primary dendrites (stemming from the cell body), and their first level of branching into secondary dendrites. In many experiments, we observe a mixture of outcomes. I.e., neurons respond differently to the same set of treatment conditions. The presence of such mixtures of branching patterns have not been taken into account in the statistical analyses to-date. We here analyze branching patterns of neurons via mixtures of hierarchical generalized linear models. We determine which factors directly affect the number of primary dendrites, the proportions of primaries that branch, and how many secondaries result from a branching event. We also determine which subset of branching features define the different mixture components. We discuss the meaning of these results from a biological standpoint. The outcome of these analyses enabled us to formulate novel biological hypotheses as to how experimental factors regulate dendritic branching. These hypotheses are currently being validated in the lab.