Gene Families With Stochastic Exclusive Gene Choice Underlie Cell Adhesion in Mammalian Cells

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Exclusive stochastic gene choice combines precision with diversity. This regulation enables most T-cells to express exactly one T-cell receptor isoform chosen from a large repertoire, and to react precisely against diverse antigens. Some cells express two receptor isoforms, revealing the stochastic nature of this process. A similar regulation of odorant receptors and protocadherins enable cells to recognize odors and confer individuality to cells in neuronal interaction networks, respectively. We explored whether genes in other families are expressed exclusively by analyzing single-cell RNA-seq data with a simple metric. This metric can detect exclusivity independently of the mean value and the monoallelic nature of gene expression. Chromosomal segments and gene families are more likely to express genes concurrently than exclusively, possibly due to the evolutionary and biophysical aspects of shared regulation. Nonetheless, gene families with exclusive gene choice were detected in multiple cell types, most of them are membrane proteins involved in ion transport and cell adhesion, suggesting the coordination of these two functions. Thus, stochastic exclusive expression extends beyond the prototypical families, permitting precision in gene choice to be combined with the diversity of intercellular interactions.
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