Models of Ocular Dominance Column Formation: Analytical and Computational Results

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Abstract: We have previously developed a simple mathemati(cid:173)cal model for formation of ocular dominance columns in mammalian visual cortex. The model provides a com(cid:173) mon framework in which a variety of activity-dependent biological machanisms can be studied. Analytic and com(cid:173) putational results together now reveal the following: if inputs specific to each eye are locally correlated in their firing, and are not anticorrelated within an arbor radius, monocular cells will robustly form and be organized by intra-cortical interactions into columns. Broader corre(cid:173) lations withln each eye, or anti-correlations between the eyes, create a more purely monocular cortex; positive cor(cid:173) relation over an arbor radius yields an almost perfectly monocular cortex. Most features of the model can be un(cid:173) derstood analytically through decomposition into eigen(cid:173) functions and linear stability analysis. This allows predic(cid:173) tion of the widths of the columns and other features from measurable biological parameters.