

The nature-nurture transform underlying the emergence of reliable cortical representations

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The fundamental structure of cortical networks arises early in development prior to the onset of sensory experience. However, how endogenously generated networks respond to the onset of sensory experience, and how they form mature sensory representations with experience remains unclear. Here we examine this 'nature-nurture transform' using in vivo calcium imaging in ferret visual cortex. At eye-opening, visual stimulation evokes robust patterns of cortical activity that are highly variable within and across trials, severely limiting stimulus discriminability. Initial evoked responses are distinct from spontaneous activity of the endogenous network. Visual experience drives the development of low-dimensional, reliable representations aligned with spontaneous activity. A computational model shows that alignment of novel visual inputs and recurrent cortical networks can account for the emergence of reliable visual representations.

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