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Title: Mapping Emotions: Discovering structure in mesoscale electrical brain recordings

Abstract: Brain-wide fluctuations in local field potential oscillations reflect emergent network-level signals that mediate behavior. Cracking the code whereby these oscillations coordinate in time and space (spatiotemporal dynamics) to represent complex behaviors would provide fundamental insights into how the brain signals emotional pathology. Using machine learning, we discover a spatiotemporal dynamic network that predicts the emergence of major depressive disorder (MDD)-related behavioral dysfunction in mice subjected to chronic social defeat stress. Activity patterns in this network originate in prefrontal cortex and ventral striatum, relay through amygdala and ventral tegmental area, and converge in ventral hippocampus. This network is increased by acute threat, and it is also enhanced in three independent models of MDD vulnerability. Finally, we demonstrate that this vulnerability network is biologically distinct from the networks that encode dysfunction after stress. Thus, these findings reveal a convergent mechanism through which MDD vulnerability is mediated in the brain.