PROJECT SUMMARY (See instructions):

The present proposal aims to combine state-of-the-art integrated transcranial brain stimulation, electroencephalographic recording techniques with genetics and computational modeling to unveil the mechanisms underlying a fundamental cortical network process - synchronization of neuronal activity in the gamma band (30–80 Hz) - and the sources of its intersubject variability. By measuring the entrainment of prefrontal cortex produced by weak oscillatory currents, we will provide a new non-invasive strategy to derive robust estimates of the cortical ability to support gamma oscillations, critically overcoming limitations associated with current approaches and allowing measures solely dependent on intrinsic regional cortico-thalamic properties. Consistent with molecular evidence and our biophysical models of gamma oscillations, we expect that such unambiguous measurement of cortical capabilities will straightforwardly map onto key genetic underpinnings related to the dopamine and neuregulin signaling pathways. These computational models will be used to offer critical mechanistic insights linking genetic variations to variability in emergent circuit-level activity in the form of cortical gamma oscillations.

RELEVANCE (See instructions):

This collaborative project integrates the cross-disciplinary expertise from two research groups to provide the framework for developing a highly innovative probe for evaluating *in vivo* frontal gamma oscillations and the means to account for the genetic underpinnings of the inter-individual variability in this cortical activity. The project will bring together the human electrophysiology, neurostimulation and modeling expertise Dr. Cho's research group together with the human genetics expertise of Dr. Walss-Bass' research group. A positive outcome in this study could provide the empirical and theoretical framework for future investigations that integrate the direct probing of cortical regions for gamma oscillations in neurologic and psychiatric disorders and development of pharmacogenetic approaches to personalizing treatments.