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Editorial

Introduction to AIMS Special Issue "How do Gamma Frequency Oscillations and NMDA Receptors Contribute to Normal and Dysfunctional Cognitive Performance"

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One of the key endeavors of neuroscience is to understand how activity is co-ordinated across the elementary objects of the brain (cells/columns/areas) to generate the coherent computations that underlie perception, memory, cognition and action. Extensive research has suggested that gamma-band oscillations, mediated in part by NMDA receptor activity, play a key role in this integration. With that in mind, AIMS Neuroscience is pleased to present this special issue entitled "How do gamma frequency oscillations and NMDA receptors contribute to normal and dysfunctional cognitive performance?" The special issue consists of three main articles and three associated commentaries.

In the first article, Pinotsis and Friston [1] demonstrate how dynamic causal modelling in combination with neural mass models can be used to decide between alternative hypotheses regarding the microstructural generators of gamma-band activity; they provide several examples of their approach from the visual system. Following this, Cadoni and Albensi [2] provide a valuable review of the biophysical basis of cortical oscillations, where they cover evidence for the role of NMDA receptors in cortical plasticity. Finally, Moss and Moss [3] explain their dimensional systems model, which assumes that the cortical column is the key unit of cortical information processing. According to their theory, gamma oscillations are necessary for the generation of the cortical column, and NMDA receptors are needed for boundary formation. Commentaries by Moss and Moss [4] and Chambers and Payne [5] follow these articles, with the latter emphasizing the importance of sleep processes in this context. Concluding the special issue, Pinault [6] argues that gamma frequency oscillations, which are enhanced by NMDA receptor antagonism, may be a valuable biomarker in several brain disorders.

The theories presented here allow for the generation of numerous experimental hypotheses that

can be tested in the laboratory. For empiricists seeking to test hypotheses in this area the challenges of working across different species and levels of analysis are large but not insurmountable. In this research area, most of our knowledge of NMDA receptor activation in humans comes from studies of ketamine, a drug that has multiple mechanisms of action in addition to NMDA antagonism. The on-going development of drugs with selective NMDA antagonism which are safe to use as research tools in humans will enable more selective targeting of the NMDA receptor and facilitate comparison across species. This will enable researchers to conduct more definitive experiments that can test some of the ideas discussed here. All the authors in this special issue no doubt agree that understanding the role and generative mechanisms of gamma oscillatory activity will be critical in understanding associated brain disorders.

Conflict of Interest

Author declares no conflicts of interest in this paper.

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