

Symposium Proposal

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An Integrative Approach to Delta and Theta Oscillatory Activity

The oscillatory dynamics of the brain provide a valid representation of mental processing (will be discussed by S. Karakaş). The complexities of the human mind can be represented by a limited number of frequencies because the functional meaning of a given oscillatory component varies according to a host factors that include: (1) enhancement, attenuation, blocking, duration, latency, time-locking, phase-locking and frequency-locking of the oscillations, (2) the topology that the oscillation is recorded from and, (3) the coherency function between different neural structures. The alpha and beta oscillations have been studied ever since Berger discovered them in 1929. The gamma oscillation is being studied since its discovery by Adrian in 1942. A review paper on the delta oscillations and the multiple functions that it represents has been possible only recently (Güntekin and Başar, 2015). Theta is even more complex. The role of the theta oscillation on the navigatory behavior earned O'Keefe and co-workers the Nobel Prize. Among the other mental processes that the component represents are selective attention, memory consolidation and episodic memory. The functional significance of the oscillations does not depend on only the oscillation-related variables. Among the many other variables is the developmental level of the subject. The study of the changes in the delta and theta responses in aging does not only have a scientific value but also provide norm values for further studies (will be discussed by D. Durusu Emek-Savaş). Currently, the level that basic science on oscillatory dynamics has reached justifies its application to neuropsychiatric disorders (will be discussed G.Gülmen Yener). Findings on amplitudes of low frequency and high-frequency spontaneous oscillations, amplitude of evoked and event-related oscillations, and coherency decrease in selective brain areas point to a set of potential biomarkers for AD and the progression from the healthy state to mild cognitive impairment. Electroencephalography is an unexcelled technique with respect to temporal resolution but not to spatial resolution. Functional magnetic resonance imaging, on the other hand, offers a high spatial resolution. Future studies on brain's cognitive processing may also make use of the equally noninvasive MRG for defining the regions that the oscillatory components are recorded from.

Güntekin, B., & Başar, E. (2015). Review of evoked and event-related delta responses in the human brain. *International Journal of Psychophysiology*.