

Spanning the rich spectrum of the human brain

Slow waves to gamma and beyond

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Comment on:

Nunez PL, Srinivasan R. (2010) Scale and frequency chauvinism in brain dynamics: too much emphasis on gamma band oscillations. *Brain Struct Funct*, 215:67-71.

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In their recent editorial, Nunez and Srinivasan (2010) assert that gamma band activity and intracranial recordings have been receiving an inordinate amount of attention in recent years. We agree that brain dynamics must be examined at all possible scales and across several frequency bands, and that it would be foolish to restrict our understanding of brain dynamics exclusively to intracranial recordings or higher frequency content. However, a number of points raised by the authors require further consideration.

How much emphasis is “too much”? A PubMed search of publications since 2007 reveals that the distri-

bution of citations across frequency bands roughly follow their corresponding power distribution in the resting scalp EEG (see Figure 1), with 1,356 papers citing alpha or mu rhythms, while 790 cite gamma band activity and only 60 mention high gamma activity. Meanwhile, since 2007, 14,992 publications have cited EEG or MEG, while only 337 mention intracranial EEG¹.

1 Historical Emphasis on Low Frequencies

Clearly, reports of alpha rhythms and scalp EEG/MEG still dominate the literature. As Nunez and Srinivasan (2010) point out, there is an extremely large body of literature describing the association of low-frequency (<20 Hz) activity with a variety of brain states, clinical conditions, and cognitive responses. Perhaps this should provide even stronger motivation to scrutinize higher frequencies, to explore the relatively uncharted territory at the frontier of neuroscience, to complement what is already known about evoked responses and lower frequency oscillations. In fact, one major reason that higher frequencies had been virtually ignored for decades is simply because this activity was either assumed to be entirely noise and therefore systematically filtered out, or deemed incompatible with the traditional phase-locked evoked response model, even in intracranial recordings. Additionally, advances in both computer technology as well as analytical techniques were necessary to bring the analysis of higher frequency brain activity to the mainstream.

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¹ search included: intracranial electroencephalography, electrocorticography, stereoelectroencephalography, depth electroencephalography, and subdural recordings. See supplementary material for precise PubMed search queries.