ANALYSIS OF TEMPORAL FREQUENCY IN LOCAL FIELD POTENTIAL OF RAT VISUAL CORTEX

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Numerous analytical methods have been applied to investigate the neuronal processing of information about temporal frequency content of visual stimuli. The most encountered methods are 1) direct measurement of response amplitude, e.g. an amplitude of averaged visual evoked potential, and 2) assessment of response magnitude after transformation of the signal from time to frequency domain.
In the current study we have attempted to find out which of these two approaches yield the best results for different frequencies of visual stimuli. Local field potentials were recorded during visual electrophysiology experiments performed on anesthetized rats in response to LED light flashing at various temporal frequencies in a range from 0.5 to 15 Hz. Visual responses were collected from all layers of the primary visual cortex.
We conclude that it is not optimal to use the same paradigm to analyze the whole spectrum of temporal frequencies. We found that for frequencies lower than 2 Hz it is difficult to draw conclusions based on power spectrum alone, and the estimation of the visual evoked potential amplitude by direct measurement should be also performed. On the other hand, for higher frequencies (> 2 Hz) the assessment of evoked potential in time domain was highly inaccurate, therefore we suggest to transform signal to frequency domain and draw conclusion based on the peak at stimulation frequency, instead. Further, our results point on the advantages of using the Welch method instead of the periodogram for the analysis of signals in the frequency domain.

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