Effects of Regular Stimulation on Physiological Recordings

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Researchers use a variety of instrumentation techniques to measure the electrophysiological responses of animals. Common techniques involve using electrodes to record the muscle response (EMG), cardiac response (EKG), and evoked response potentials (ERP) of the cortex. Researchers use ERPs to determine how areas of the cortex can respond to certain stimuli, and can be used to measure if the measure the local sleep state. To generate an ERP from the animal, many different stimulation types and paradigms can be used. Most frequently, stimulations with regular interstimulus intervals (ISIs) are employed. However, using regular ISIs runs the risk of causing entrainment in the very systems that the experimenter is trying to measure and may result in either a false response or lack of response. For example, if an animals heartbeat entrains to stimuli so that the same phase of the heartbeat occurs during the stimulation, the cycle of the heartbeat would affect the cortical response (Sandman, 1982). To measure the effect of regular stimulation on physiological systems, we implanted Sprague-Dawley rats with screw electrodes over the cortex, a pair of flexible EMG wires in the neck and a pair of similar wires that extended to the thoracic cavity to measure EKG rhythms. We then ran complementary experiments with random and regular ISIs, stimulating with auditory clicks, to observe the physiological differences. We hypothesize that stimulating with regular ISIs will cause physiological entrainment that will result in noticeably different responses than recordings done with random ISIs. We have found a noticeable increase in the peak-to-trough amplitude of the averaged ERPs during regular stimulations compared to that of random stimulation. The preliminary data seems to suggest that the use of regular stimulations does cause evoked responses that are significantly different from random stimulation, which might be caused by physiological entrainment. If this is the case, these effects need to be accounted for in the future.