

# EEG Data Logging with the NeuroLogger® System: Spontaneously Occurring Electrophysiological Correlates of Migraine in Mutant Mice

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Migraine is an episodic neurological disorder with spontaneously reoccurring headaches with or without aura. The best described correlates of migraine on the EEG level are neuronal hyper-excitability and cortical spreading depression. These phenomena are investigated in animal models by eliciting them pharmacologically, chemically, mechanically and/or electrically. Studies, investigating these phenomena when they occur spontaneously in freely moving animals are missing. To fill this gap and to investigate spontaneously occurring neurological correlates of migraine in freely moving mice, we used the cable free, non-telemetric data logging system, (NeuroLogger®) in genetically modified mouse lines like the *Cacna1a* mutants, which carry a point mutation (R192Q) in P/Q-type Ca<sup>2+</sup>-channel gene (*cacna1a*) originally described in patients with familial hemiplegic migraine. The NeuroLogger® is a microchip (16 bit MSP430 32 kb Flash, 1kb RAM processor; UART) with 750 kbit/s service interface. It is powered by two 1.4 V hearing aid Zink-air batteries and weighs about 2.8 g. It has 4 EEG channels, each sampling up to 500 Hz, 2 reference channels, 1 passive rolling ball as movement detector, and 1 synchronization channel for event marking and/or synchronizing the EEG record with

behavioral records like video monitoring (1). The inputs to the NeuroLogger® are unity gain buffered with the AC input range of +/- 750  $\mu$ V, the four EEG channels have 1000x gain and are band-pass filtered 1-70 Hz. ADC resolution is 8 bit. Electrophysiological data is stored in hexadecimal format and can be converted either to the Spike2 (CED, UK) compatible file format (smr) or to the MatLab compatible file format (mat). With the NeuroLogger® System we successfully recorded EEG with 500 Hz sampling rate on 4 channels over 16 hrs and found that freely moving *Cacna1a* mutant mice have spontaneously occurring paroxysmal neocortical activity consistent with a neocortical hyperexcitability observed in animal models of migraine and in human migraine patients.

## Keywords

Freely moving, EEG, synchronized video recording.

## REFERENCES

1. Lars E. et al. Seizure logging: A novel approach to combined synchronized cable free EEG-registrations and Video recordings of seizure activity in the mouse. Submitted to *Neurosci Meth.*

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