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An integrated system for synchronous detection of neuron spikes and dopamine activities in the striatum of Parkinson monkey brain

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Highlights

This work provides a novel integrated system for monitoring neuron spikes and dopamine (DA) activities in non-human primate brain. In summary, the highlights of the work are:

- The integrated system greatly simplifies the experimental operation. Moreover, the experimental efficiency, the signal quality and synchronization performance are improved significantly.
- Significant differences including lower DA concentrations in the striatum and higher spike rates in Parkinson model monkey than those of the normal one are detected by this integrated system during inserting the MEA from cortex to striatum.
- This is a novel demonstration to record neuron spikes and DA activities in the non-human primate brain simultaneously with an integrated system.

Abstract

Background: Synchronous detecting neuron spikes and dopamine (DA) activities in the non-human primate brain play an important role in understanding of Parkinson's disease (PD). At present, most experiments are carried out by combing of electrodes and commercial instruments, which are inconvenient, time-consuming and inefficient.

New method: Herein, this study describes a novel integrated system for monitoring neuron spikes and DA activities in non-human primate brain synchronously. This system integrates an implantable sensor, a dual-function head-stage and a low noise detection instrument.

Methods: The system was developed efficiently by using the key technologies of noise reduction, interference protection and differential amplification. To demonstrate the utility of this system, synchronous recordings of electrophysiological signals and DA were *in vivo* performed in a monkey before and after treated as a Parkinson model monkey.

Results: The system typically exhibited input-referred noise levels of only ~ 3 μV_{RMS}, input impedance levels of up to 5.1 GΩ, and a sensitivity of 14.075 pA/μM for DA and could detect electrophysiological signals and DA without mutual interference. In monkey experiments, lower DA concentrations in the striatum and more