



Apr 14, 2024

FSCV and Ephys Recording Setup

 [eNeuro](#)

DOI

<https://dx.doi.org/10.17504/protocols.io.yxmvme785g3p/v1>

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Protocol Citation: Raymond Murray, Helen Schwerdt 2024. FSCV and Ephys Recording Setup. **protocols.io**
<https://dx.doi.org/10.17504/protocols.io.yxmvme785g3p/v1>

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Protocol status: Working



Created: April 07, 2024

Last Modified: April 14, 2024

Protocol Integer ID: 97884

Keywords: ephys recording setup method, scan cyclic voltammetry, recording setup, fscv, ephy

Abstract

Methods detailing the recording setup using both electrophysiological (Ephys) and fast-scan cyclic voltammetry (FSCV) are described.

Recording Setup

- 1 One to four selected probes were utilized to record dopamine concentrations using fast scan cyclic voltammetry (FSCV) while electrophysiological (Ephys) activity was recorded from all other implanted probes not connected to FSCV. Probes used to record dopamine in a given recording session were switched to record local field potentials (LFPs) in later recordings sessions to allow for recording both types of signals from the same site, and vice versa for probes originally recording LFPs.
- 2 A current-to-voltage converting head stage circuit was employed on probes recording FSCV, allowing the recording of current during concurrent application of a triangle wave via the FSCV system.
- 3 Remaining probes were alternatively connected to a voltage-follower head stage circuit for Ephys recording to be amplified and digitized using the Digital Lynx SX system from Neuralynx.
- 4 Ag/AgCl electrodes surgically implanted in the animal's epidural tissue or brain matter were grounded by the FSCV system, also serving as the FSCV and Ephys reference. The Ephys system ground was connected to the experimental rig.
- 5 FSCV scans consisted of applying a triangle wave to each probe at a rate of 400 V/s at a frequency of 10 Hz. Specifically, each scan lasted 8.5 ms consisting of an initial ramp from -0.4 V to + 1.3 V, then returning -0.4 V. Color plots were generated by background subtracting currents at a specific timepoint and plotting scan voltage on the y-axis, time on the x-axis, and current change amplitude as color.
- 6 Dopamine redox was identified according to current changes at -0.2 and 0.6 V relative to the reference Ag/AgCl electrodes during each scan.
- 7 Principal component regression analyses and correlation to dopamine and pH standards recorded from an in vitro flow cell environment were performed to ensure recorded currents were mostly related to dopamine redox.
- 8 The Ephys system recorded voltage inputs with a ± 1 mV range at 30 kHz with an applied bandpass filter from 0.1 Hz to 7500 Hz.
- 9 This system also recorded time stamps of identified task events utilizing parallel ports that conveyed 8-bit event codes. Software functions and a messaging system used concurrently with the Ephys system allowed for common time stamp output between the Ephys and FSCV systems.