Supplementary Figures

Multiplexing Neurochemical Detection with Carbon Fiber Multielectrode Arrays using Fast-Scan Cyclic Voltammetry

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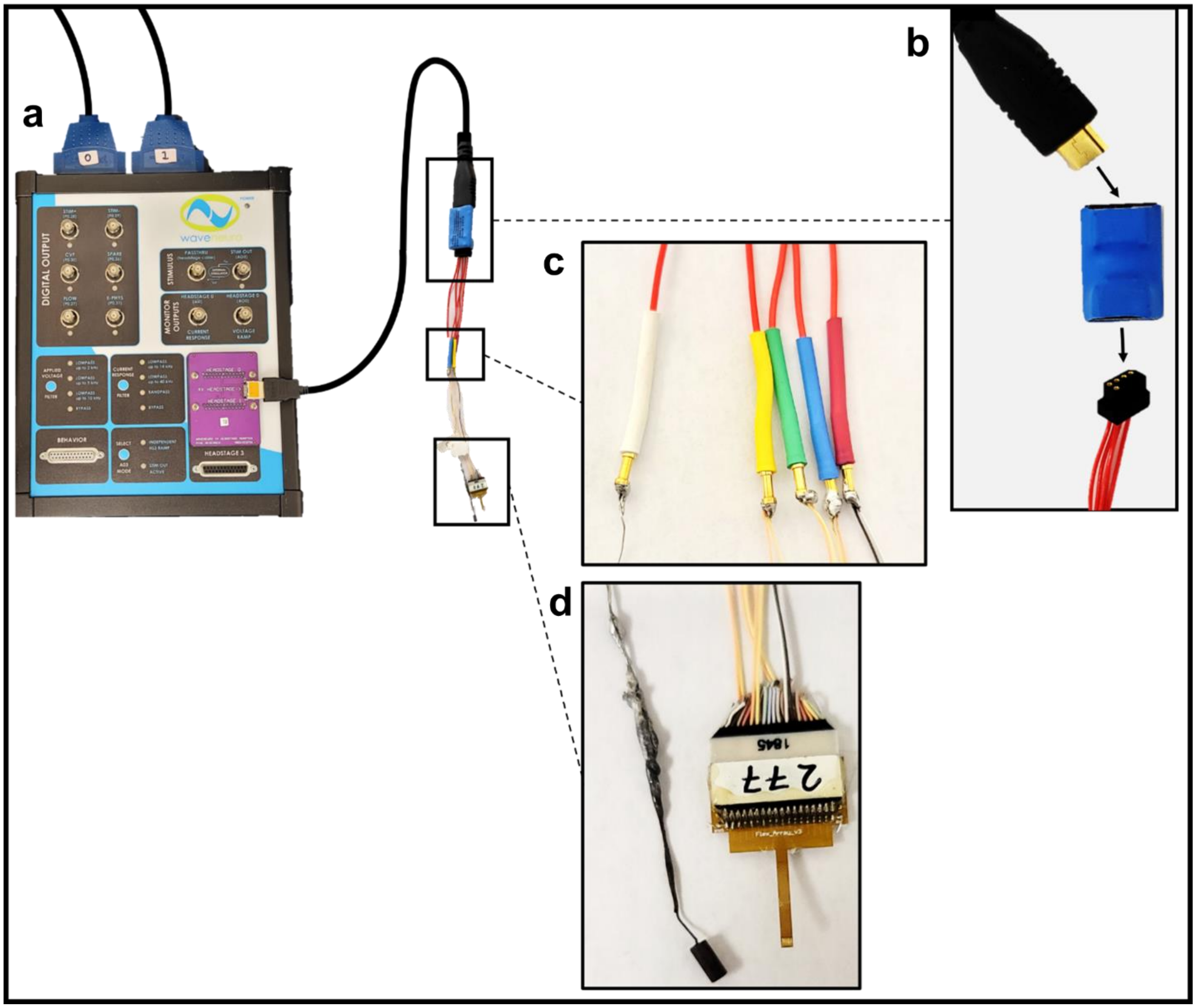


Fig. S1 (a) WaveNeuro Four Multichannel Fast Scan Cyclic Voltammetry (FSCV) Potentiostat from Pine Research. Attached to the top of the potentiostat are interface cables 0 and 1, which connect to the data acquisition interface board within computer. On the lower left of the potentiostat, the four channel headstage adapter, in purple, is inserted and tightened with screws to hold it in place. The (b) black, four-channel headstage cable connects to multiple tiers of adapter to fit the multielectrode array. The blue, four channel FSCV headstage amplifier (5 MΩ, 200 nA/V) attaches to the black and red four channel headstage-to-microelectrode coupler wire assembly. (c) Gold pins connect to the multielectrode arrays at the end of the coupler and to the (d) Omnetics connecter via another adapter. The white wire connects to a reference wire with a soldered Ag/AgCl pellet (reference electrode, 0.197 V) at the end. The other four colors correspond to channels 1-4 with blue as channel 1, yellow as channel 2, green for channel 3, and red for channel 4. These colors do not necessarily correspond to the oscilloscope colors in the software and can be changed to do so.

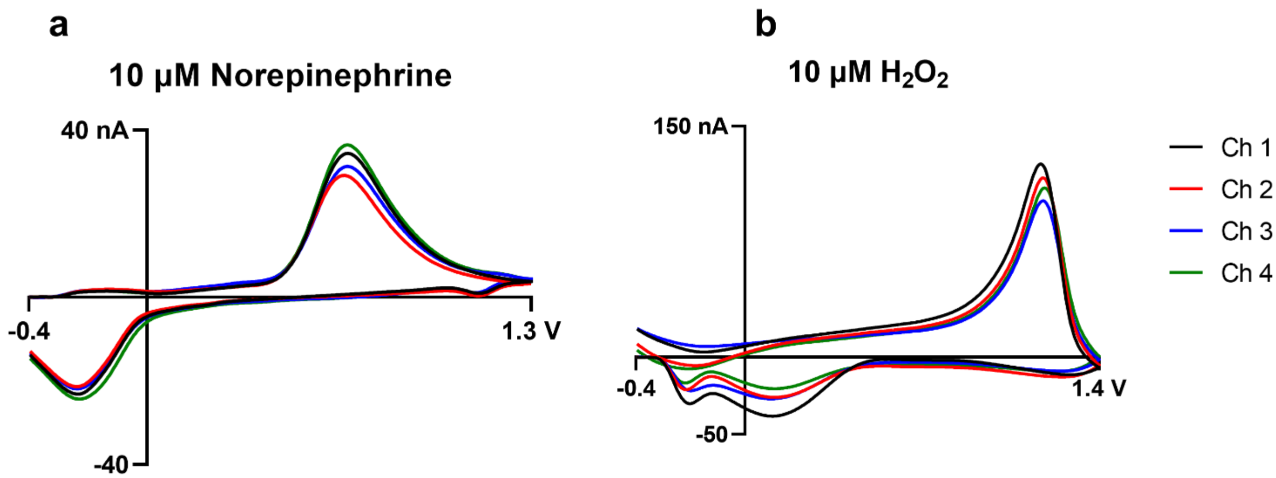


Fig. S2 (a) Multielectrode array CV 10 µM of norepinephrine (NE) using the DA triangle waveform. (b) Multielectrode array CV of 10 µM of hydrogen peroxide using a triangle waveform.

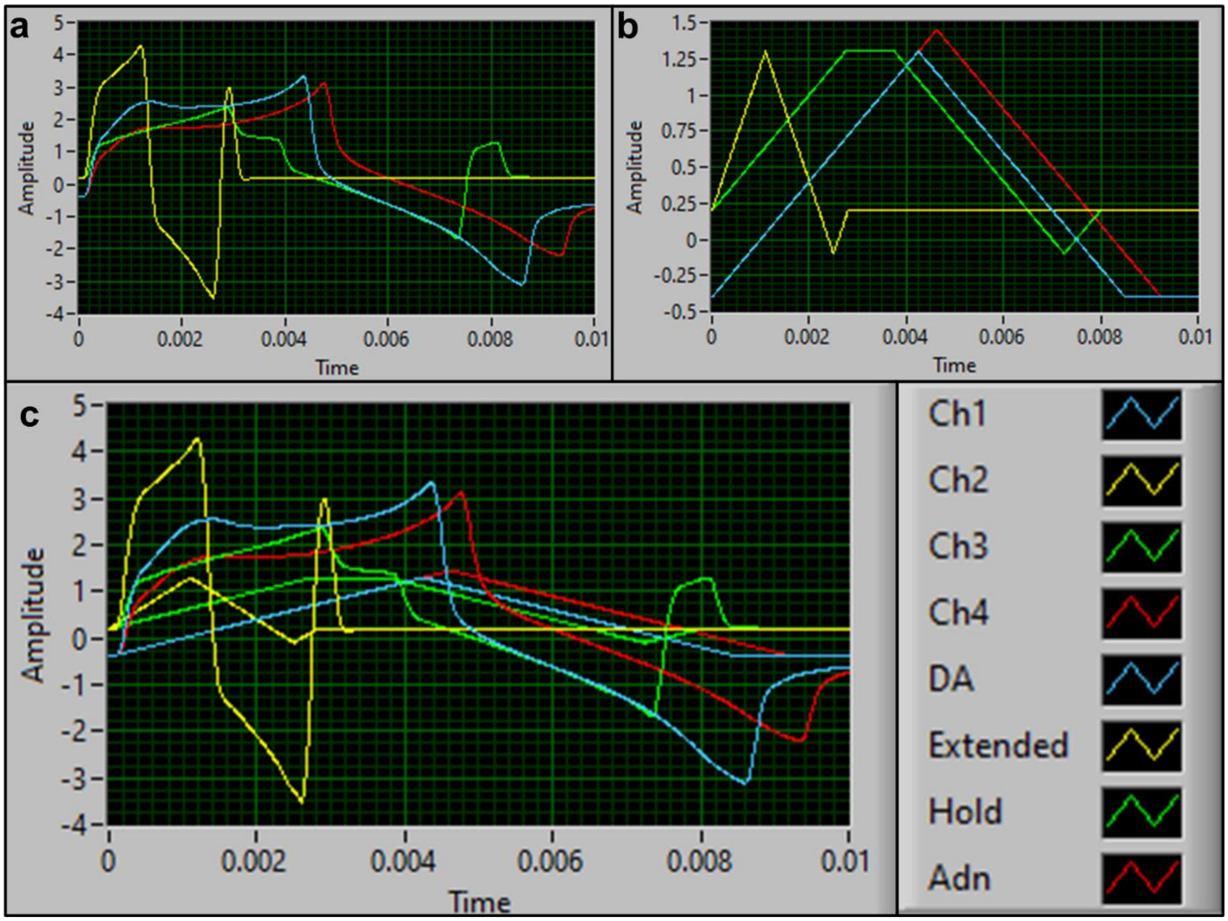
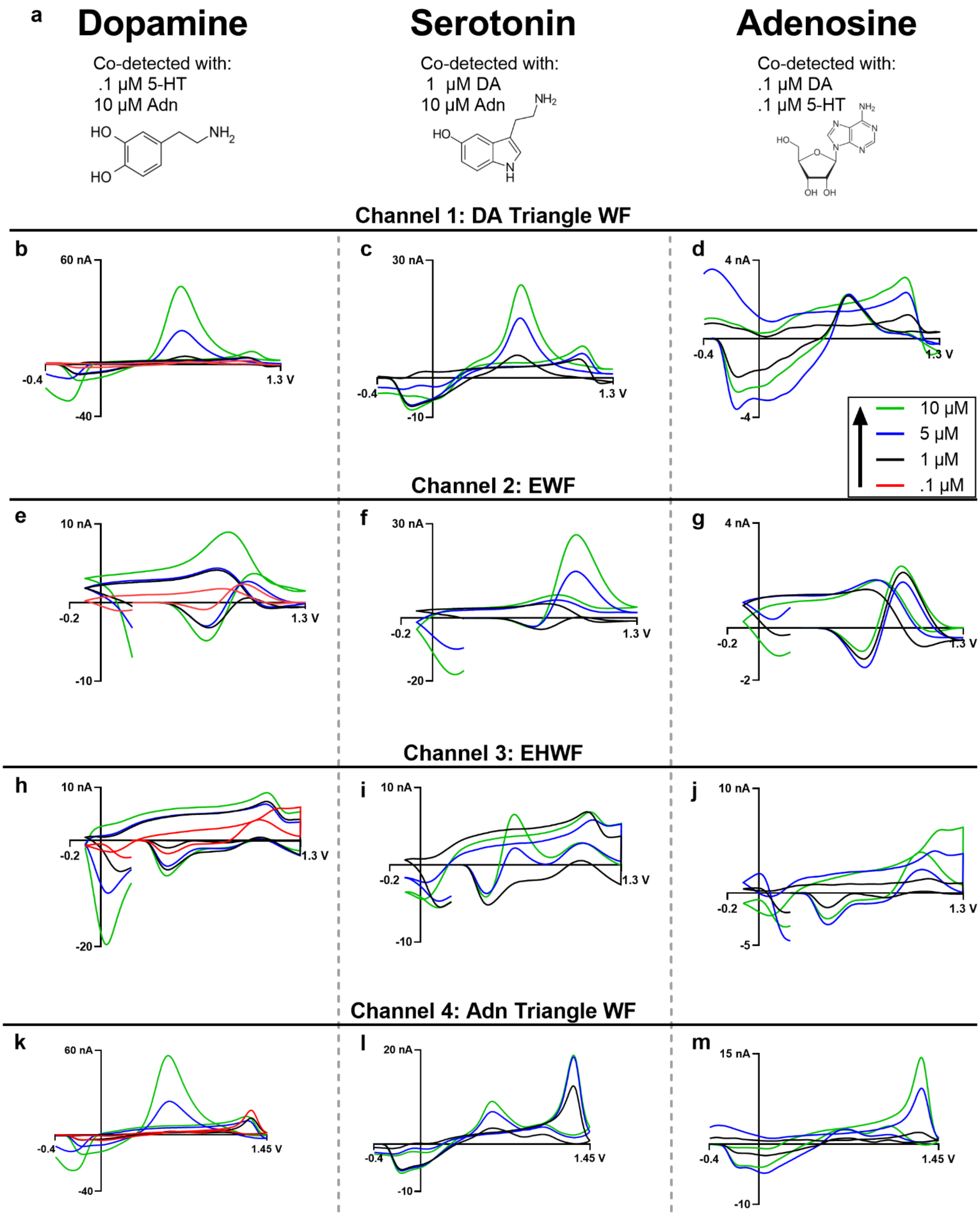


Fig. S3 Multiple waveform application onto the multielectrode array. (a) Oscilloscope of waveforms applied onto each multielectrode array and (b) the waveform shapes: Dopamine, Extended, Hold, and Adenosine triangle waveform. The individual waveform parameters are described in the manuscript. (c) Overlay of waveforms applied onto the multielectrode array and the oscilloscope of channels 1 – 4. Channel 1 in blue corresponds to the dopamine triangle waveform, channel 2 in yellow is applied with the serotonin extended waveform, channel 3 in green is the serotonin hold waveform, and channel 4 in red is the adenosine triangle waveform, as seen in the legend on the right-hand side of c.



a
Dopamine
Co-detected with:
.1 µM 5-HT
10 µM Adn
Serotonin
Co-detected with:
1 µM DA
10 µM Adn
Adenosine
Co-detected with:
.1 µM DA
.1 µM 5-HT
Channel 1: DA Triangle WF
b
c
d
10 µM
5 µM
1 µM
.1 µM
Channel 2: EWF
e
f
g
Channel 3: EHWF
h
i
j
Channel 4: Adn Triangle WF
k
l
m

Fig. S4 Multi-waveform codetection. (a) Each analyte; dopamine, serotonin, and adenosine, was detected with increasing concentrations using each of the four waveforms: triangle, extended, extended hold, and adenosine. The dopamine triangle waveform is optimized for dopamine detection and the adenosine waveform is optimal for adenosine detection, while the extended waveforms enhance serotonin measurement. The co-detection mixture and structures are included. (b) Increasing DA concentrations co-detected with .1 µM 5-HT and 10 µM adenosine (abbreviated *Adn* on the graphs), using the DA triangle (b), EWF (e), EHWF (h), and adenosine triangle (k), applied onto channel 1 through 4 respectively. Increasing 5-HT concentrations co-detected with 1 µM DA and 10 µM adenosine using the DA triangle (c), EWF (f), EHWF (i), and adenosine triangle waveform (l).
Increasing adenosine concentrations co-detected with .1 µM 5-HT and .1 µM DA using the DA triangle (d), EWF (g), EHWF (j), and adenosine triangle waveform (m).
These CVs indicate how the peak oxidative current shifted for each analyte based on increasing concentration while maintaining a constant concentration of the mixture.

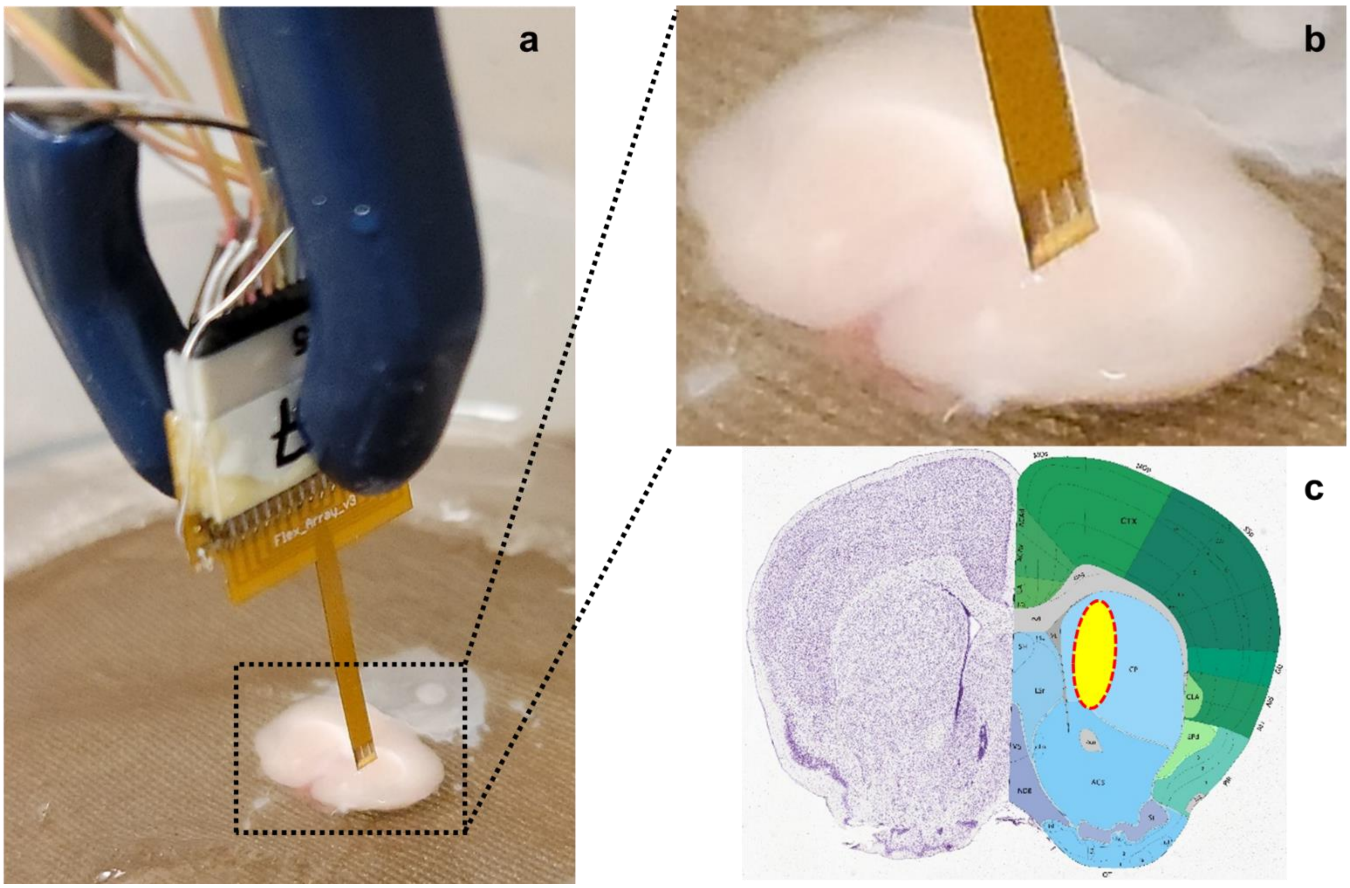


Fig. S5 Photographs of the mouse tissue experiments taken using a Samsung camera. (a) Implantation of multi carbon fiber multielectrode array in brain tissue. (b) Zoomed-in high magnification of multielectrode array in brain tissue. (c) Approximate brain region targeted by Multielectrode array.