Supporting Information

Receptor-Mediated Field Effect Transistor Biosensor for Real-Time Monitoring of Glutamate Release from Primary Hippocampal Neurons

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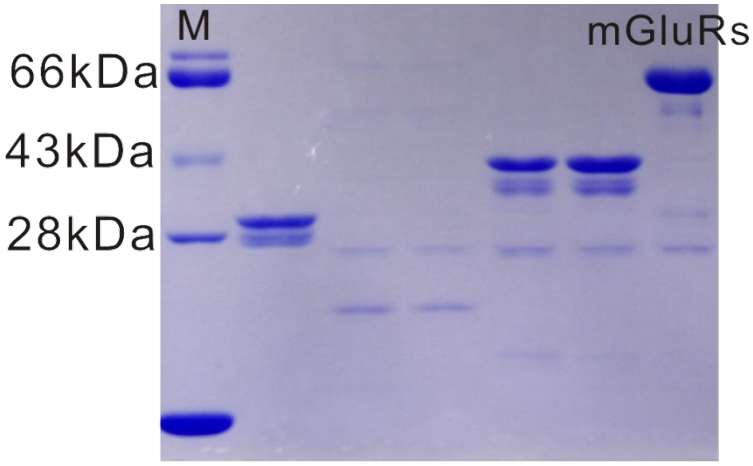

Figure S-1. Coomassie Brilliant Blue staining of affinity purified mGluRs after running on a SDS-PAGE gel.

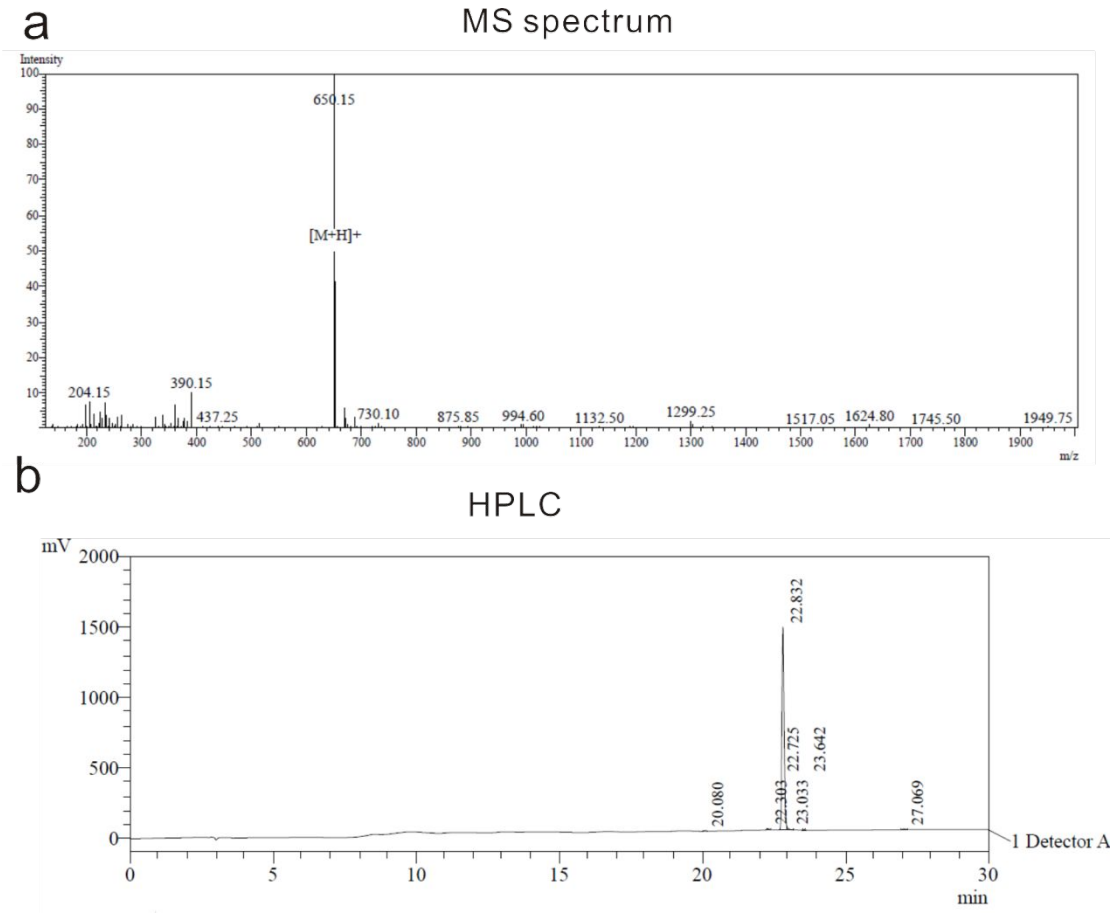

Figure S-2. Mass spectrometry and high performance liquid chromatography shows that 6-aminohexanoic acid fluoresce in isothiocyanate labeled glutamate (FITC-Ahx-Glu) was successfully synthesized and the purity was above 98%.

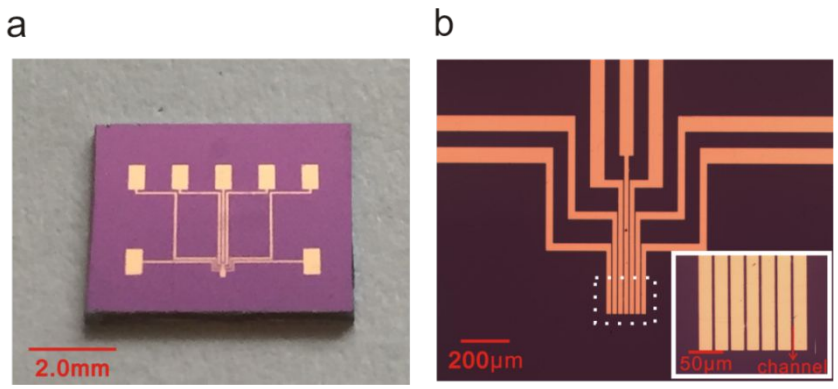

Figure S-3. (a) Optical image of one FET biosensor chip. (b) Optical image of the 6 individual sensor arrays.

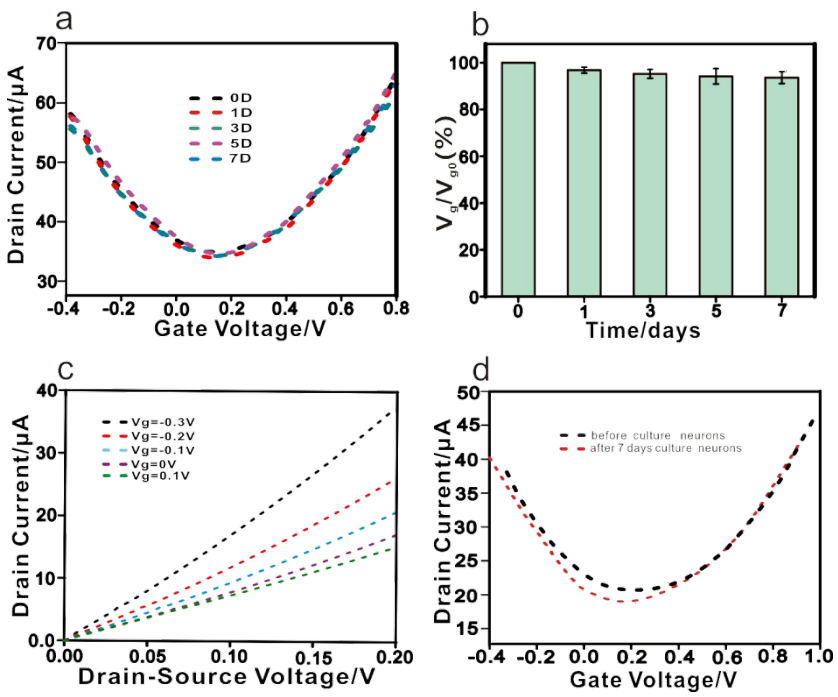

Figure S-4. (a) Stability test for the mGluR/RGO-FET immunoreacted with 10pM Glu in culture medium for one week. (b)The corresponding signal changes in the histogram. (c) I_{ds}–V_{ds} output characteristics of the mGluR/RGO-FET sensors after 7 days of culturing neurons. The gate voltage is varied from −0.3 to 0.3 V with an interval of 0.1 V. (d) I_{ds}–V_g output characteristics of the mGluR/RGO-FET sensors before and after 7 days of culturing neurons.

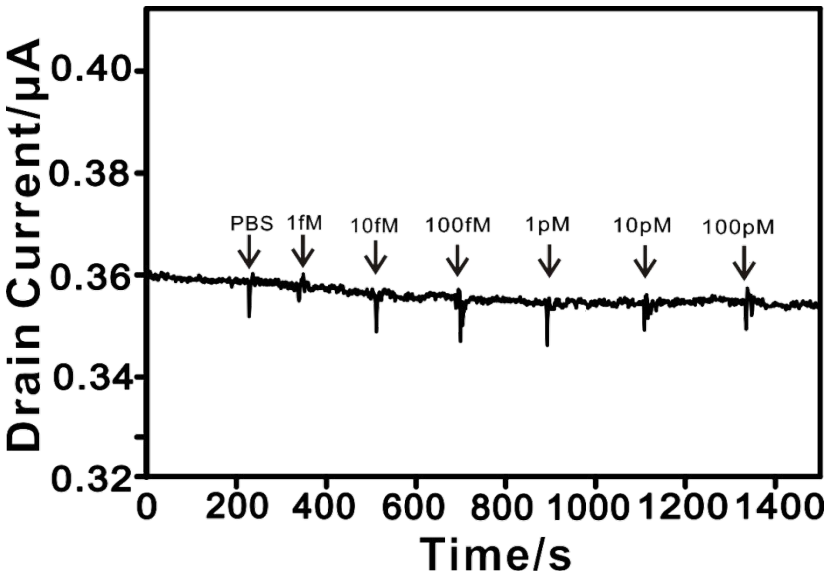

Figure S-5. Real time results of RGO-FET addition of a series concentration of glutamate without immobilization with mGluRs.

Table S-1. Comparison of various glutamate sensors

Method	Linear range	Detection limit	Response time	Ref.
Ceramic-based multisite microelectrode (Enzyme-EC)	0.5-800 μM	0.5 μM	1 s	1
Bienzyme Microelectrodes (Enzyme-EC)	0.5-50 μM	0.5 μM	35 s	2
Planar electrodes array (Bienzyme-EC)	0.5-60 μM	0.5 μM	35 s	3
Pt/GOx/PPD (Enzyme-EC)	N/A	20 nM	2 s	4
OECS (Dual Enzyme-EC)	50-300 μM	4.5 μM	N/A	5
GluOx/Pt/CFMDE (Enzyme-EC)	1-200 μM	0.87 μM	70 ms	6
Enzyme-immobilized CNT-FET	0.3-15μM	200 μM	N/A	7
Enzyme-modified floating-gate FET	0.1-500 μM	100 nM	N/A	8

PEDOT:PSS/Pt NPs OECTs (Enzyme-OECT)	0.9-14 μM	5 μM	N/A	9
Receptor-MediatedFET	**1 fM-100 pM**	**1 fM**	**1.1 s**	**This work**

EC: Electrochemistry, Pt/GOx/PPD: Pt/$_L$-glutamateoxidase/poly-ortho-phenyl-enediamine, OECS: Online electrochemical system, GluOx/Pt/CFMDE: glutamate oxidase/Pt/carbon fiber micro-disk electrode, PEDOT:PSS/Pt NPsOECTs: poly(ethylene dioxythiophene) doped withpoly (styrene sulfonate)/Pt nanoparticles/organic electrochemical transistors.

Reference:

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