Supporting Information

Ordered Fiber Ionic Pathways for Wide-Frequency Regulation in Electrolyte-Gated Transistors for Bio-signal Perception

Jun Li,[a,b] * Jupeng Wu,[a] Lian Cheng,[a] Dong Li,[b] Giyosiddin Khaydarovich Mavlonov,[c] Sobirjon Isamov,[c] Yuxing Lei,[a] and Jianhua Zhang[a,b]

[a] School of Microelectronics, Shanghai University, Jiading, Shanghai 201800, People's Republic of China.

[b] Key Laboratory of Advanced Display and System Applications, Ministry of Education, Shanghai University, Shanghai 200072, People's Republic of China

[c] Tashkent State Technical University, 100095, Tashkent, Uzbekistan

* Corresponding authors: lijun_yt@shu.edu.cn (J. Li)

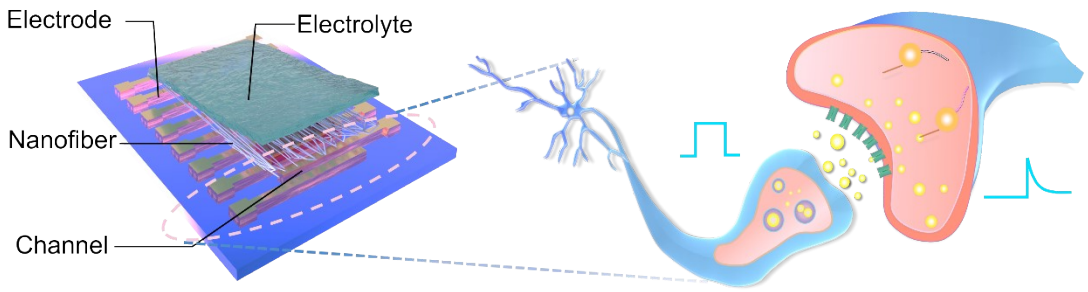

Figure S1 Schematic illustration of neuron and biological synapse.

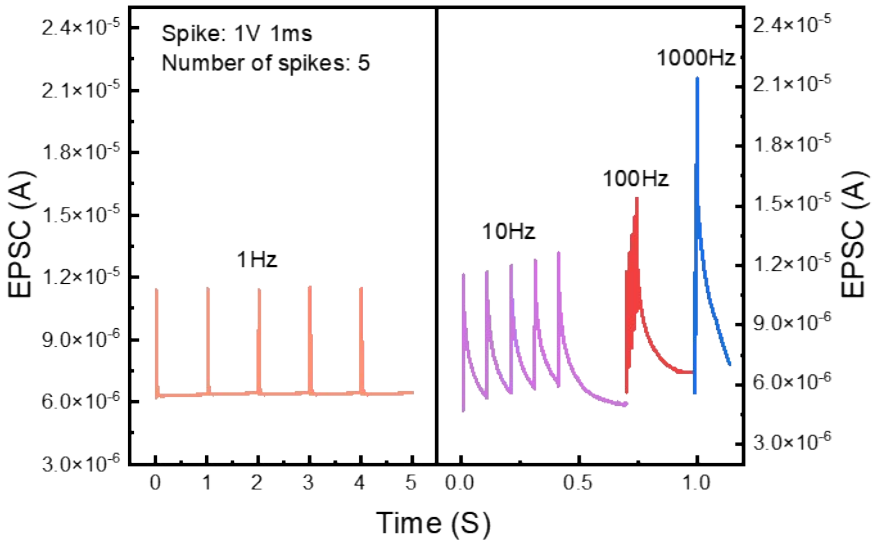

Figure S2 EPSC triggered by 5 continuous voltage spikes (1V, 1 ms) with various spike frequencies (from 1Hz to 1000 Hz).

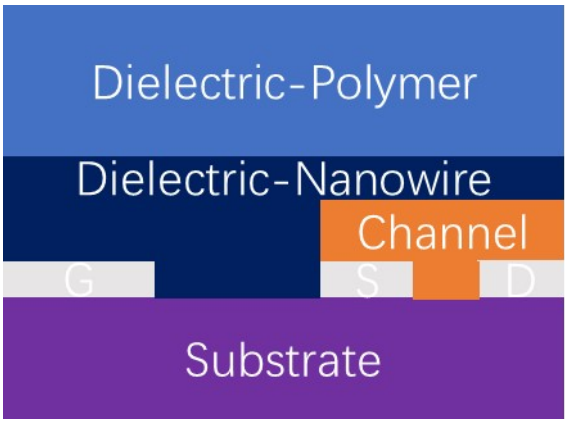

Figure S3 This coplanar gate highlights the complete cross-sectional view of the transistor, including the substrate, source(S)-drain(D) gate electrode(G), channel, and quasi-solid-state nanofiber composite electrolyte.

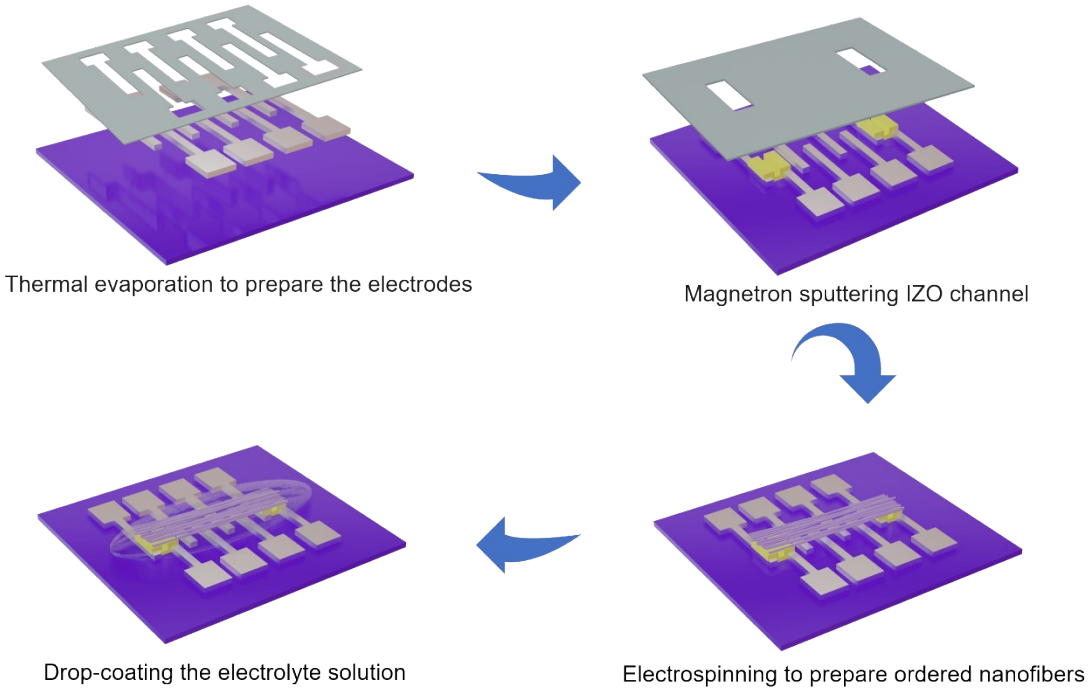

Figure S4 The device manufacturing flow chart, respectively, corresponds to the thermal evaporation preparation of aluminum electrode, magnetron sputtering deposition channel, covering ordered nanofibers and coating quasi-solid electrolyte four steps.

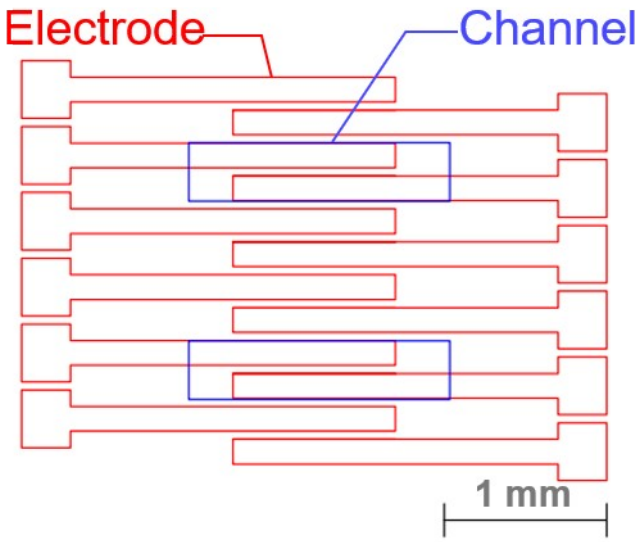

Figure S5 The inorganic portion of the device and the corresponding multi-gate layout.

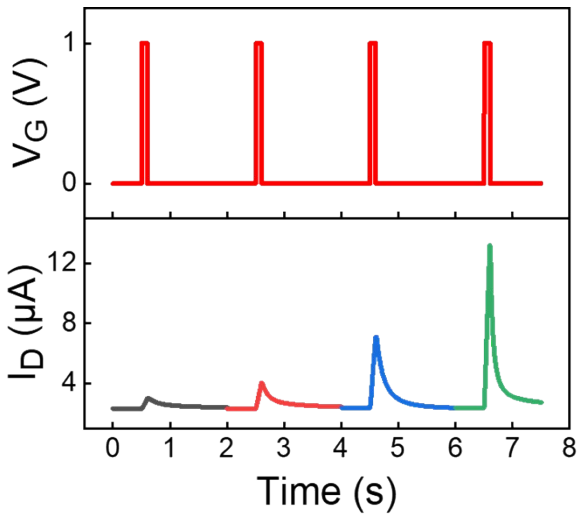

Figure S6 Verify the spatial gating effect of the interdigitated electrodes, with the same pulse train input through different electrodes (Gate 4, Gate 3, Gate 2, Gate 1 from left

to right), corresponding to the measured EPSC plot.

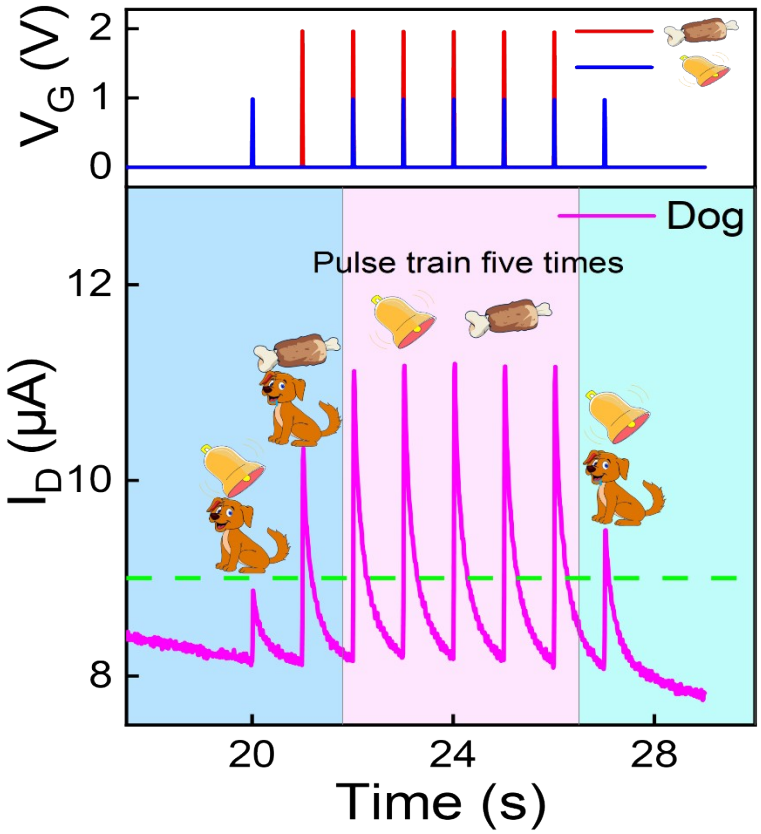

Figure S7 In this experiment, the egt simulated the process of ringing, feeding, and drooling, as shown in the figure. Take 1V pulses and 2V pulses to simulate ringing and feeding, respectively. 9 μA is set as the threshold for judging if the dog is drooling. The postsynaptic current before training was less than 9 μA, the pulse was 1V, and the pulse was greater than 9 μA, indicating that the experimental dog did not drool over the bell sound before training. After 5 training sessions, consisting of a series of 1V and 2V pulses, the postsynaptic current was greater than 9 μA when the 1V pulse was stimulated again, indicating that the experimental dog drooled over the sound of the bell and the training was successful. This phenomenon shows that EGT successfully simulates Pavlov's experiment and has good long-term synaptic plasticity.

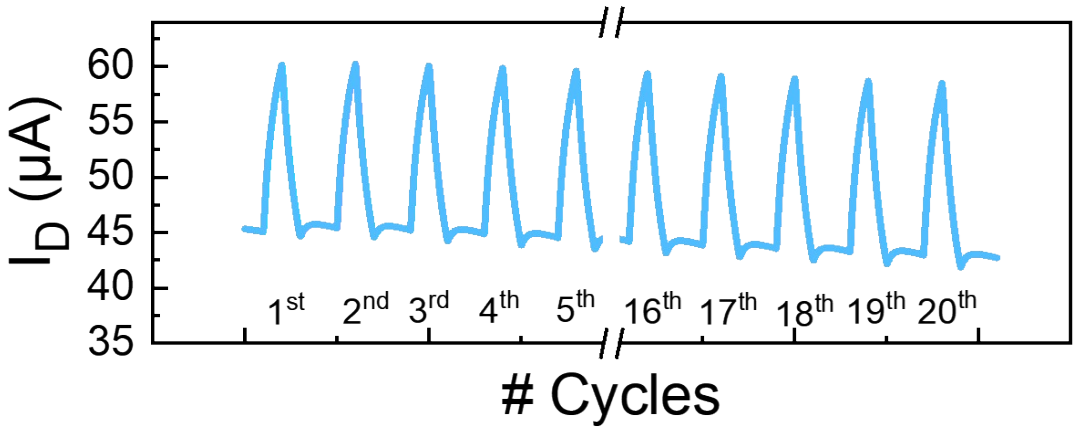

Figure S8 The figure shows 20 cycles of long-term enhancement and long-term inhibition,each long-term potential process contains 50 positive pulses and each long-term suppression process contains 50 negative pulses with pulse widths of 1 ms and amplitudes of 2 V and -0.7 V, respectively.

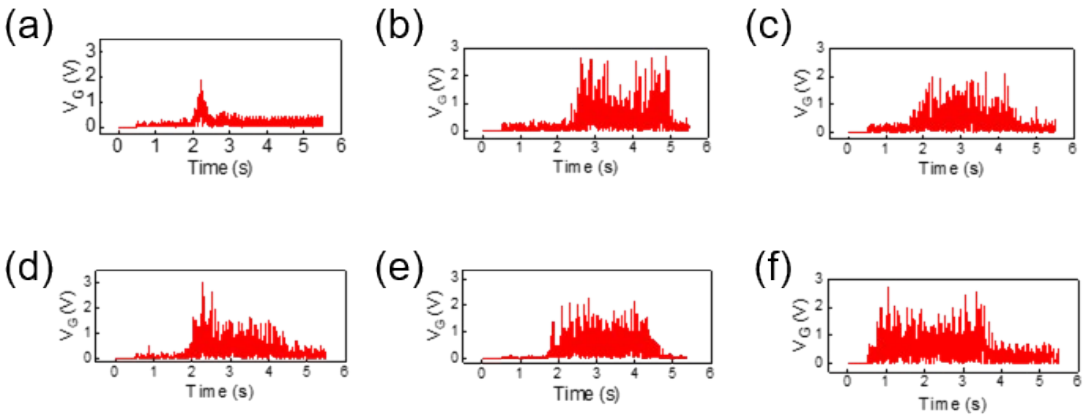

Figure S9 Figure S8 collects a series of body surface EMG signals for thumbs and other gestures as a voltage input to the grid. By attaching a standard surface EMG electrode to the surface of the skin, it is filtered, amplified and taken in absolute values in the range of 20 Hz to 500 Hz.

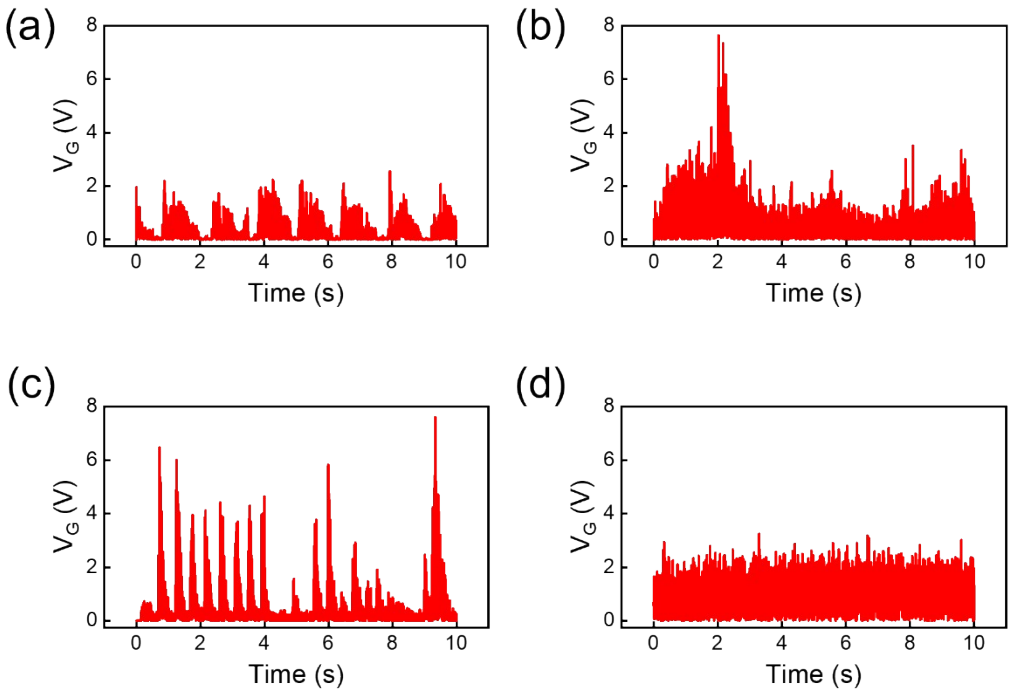

Figure S10 The audio signals corresponding to singing sound, traffic noise, iron collision sound and mechanical pump sound are digitally amplified and taken as absolute values by MATLAB.

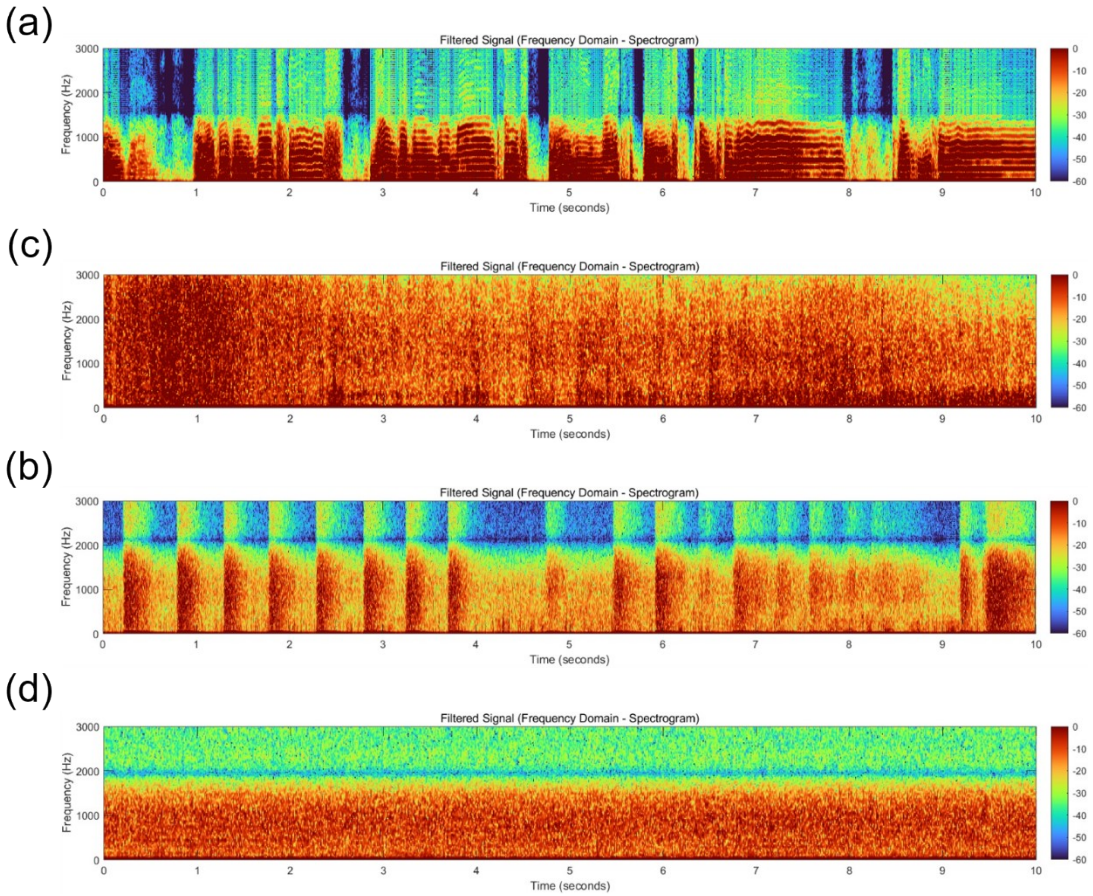

Figure S11 The spectrograms of the audio signal after positive and band-pass filtering, the main frequency distribution within 1-1500Hz. The sampling frequency is 48 kHz.