Supporting information for:

Graphene and Nanowire Transistors for Cellular Interfaces and Electrical Recording

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This file includes:

Supplementary Figure S1, S2, S3

Supplementary References S1-S4

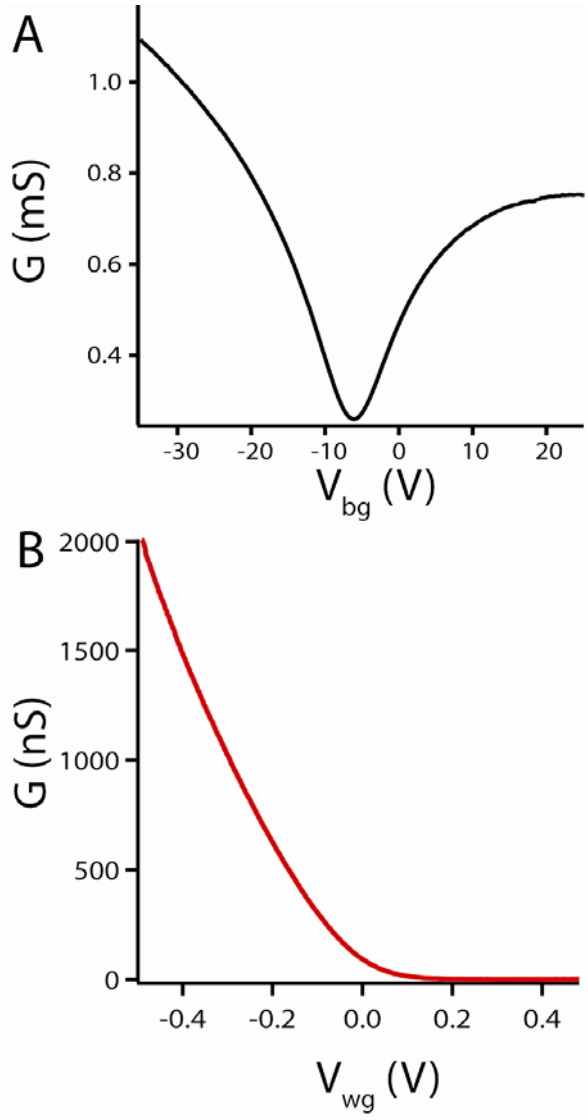

Figure S1. Representative gate responses of graphene and SiNW FETs. (**A**) Conductance (G) vs. back-gate voltage (V_{bg}, voltage applied to the doped silicon substrate) of a Gra-FET fabricated on silicon substrate with a 285 nm SiO_2 dielectric thickness. V_{bg} was varied from -35 to +25 V with a source-drain bias, V_{sd}, of 100 mV. The Gra-FET exhibited ambipolar behavior with minimum value of G at ca. -7 V. Analysis of the back-gate data yield a Gra-FET mobility of 4000 and 3550 cm^2/V-sec for hole and electron carriers, respectively, which is consistent with reported values for mechanically exfoliated single-layer graphene.[S1] (**B**) G vs. water gate voltage (V_{wg}) for the SiNW FET that was used to record SiNW data in Figure 4 C and D. The device sensitivity is 2.05 μS/V at V_{wg} = 0 V.

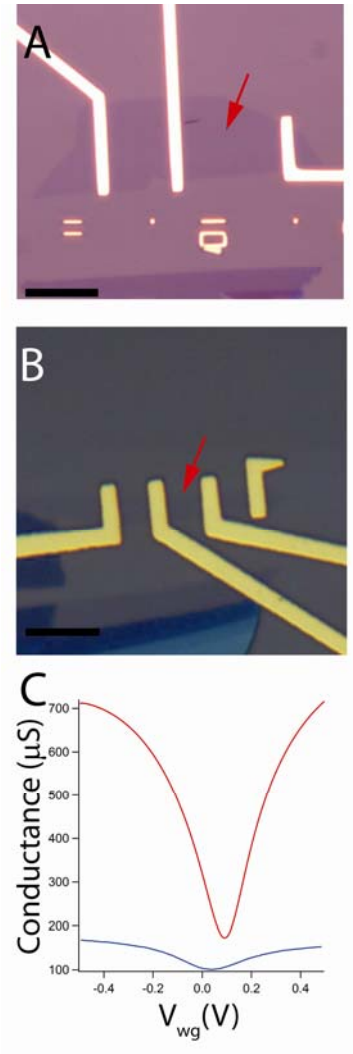

Figure S2. Optical images and water gate response of the graphene devices used in Figure 4. The number of layers in mechanically-exfoliated graphene used to fabricate Gra-FETs was assessed by interference contrast as described previously.[S2-S4] (A) Optical image of the 20.8 μm × 9.8 μm Gra-FET device used in Figure 4A and B (red arrow). The SiO_2 thickness on the silicon chip is 285 nm; scale bar is 15 μm. (B) Optical image of the 3.4 μm × 2.4 μm Gra-FET used in 4C and D (red arrow). The SiO_2 thickness on this chip is 310 nm; scale bar is 7 μm. In both cases, it is possible to observe the contrast difference between single layer vs. multiple layers of graphene that can be observed at the bottom parts of the panels. (C) Water gate response of 20.8 μm × 9.8 μm Gra-FET device (Figure 4A, B) marked as red trace, and the 3.4 μm × 2.4 μm Gra-FET device (Figure 4C, D) marked as blue trace.

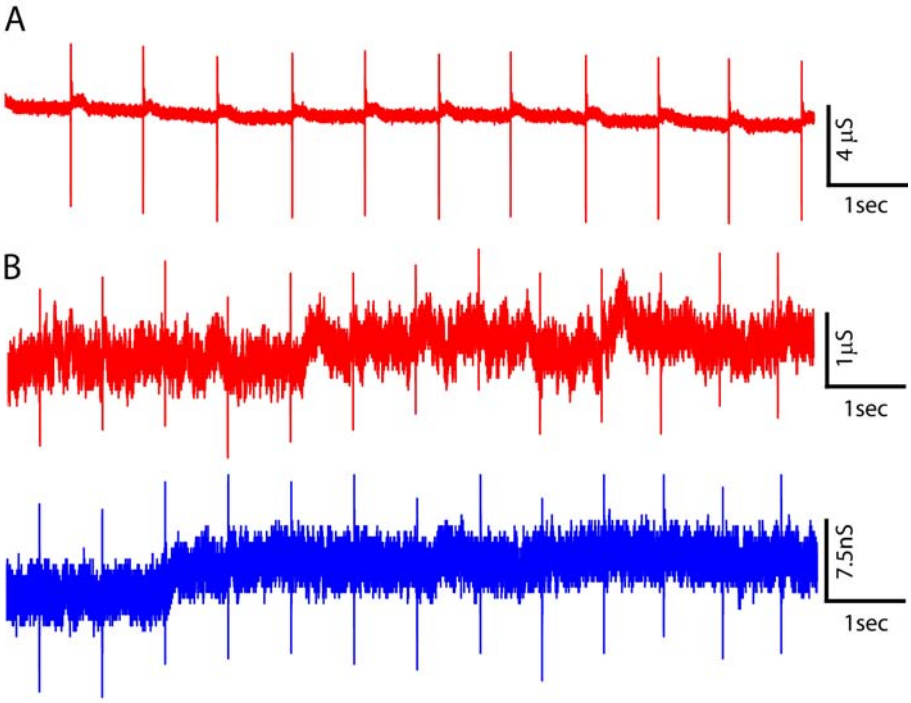

Figure S3. Conductance vs. time signal traces from embryonic chicken cardiomyocytes recorded using graphene and SiNW-FETs. (A) Representative Gra-FET recorded conductance vs. time trace of a beating cardiomyocyte used in Figure 4B. The graphene device channel was 20.8 μm × 9.8 μm (channel length × width). Recorded signals yielded regularly spaced peaks with a frequency of ca. 1.1 Hz. (B) Representative conductance vs. time trace traces recorded with a Gra-FET (up, red trace) and SiNW-FET (bottom, blue trace) used for Figure 4C. The graphene device channel was 3.4 μm × 2.4 μm (channel length × width) and the SiNW device channel was 2.2 μm × 0.03 μm (channel length × width). The SiNW-FET was located 10 μm from the Gra-FET. Recorded signals yielded regularly spaced peaks with a frequency of ca. 1.3 Hz. The embryonic chicken cardiomyocytes were cultured on thin sheets of PDMS and interfaced to the FET devices as described in the main text and references.

Supplementary References.

S1. Novoselov, K. S.; Geim, A. K.; Morozov, S. V.; Jiang, D.; Zhang, Y.; Dubonos, S. V.; Grigorieva, I. V.; Firsov, A. A. *Science* **2004**, *306*, 666-669.

S2. Blake, P.; Hill, E. W.; Castro Neto, A.H.; Novoselov, K. S.; Jiang, D.; Yang, R.; Booth, T. J.; Geim, A. K. *Appl. Phys. Lett*. **2007**, *91*, 063124-1-063124-3.

S3. Geim, A. K.; Novoselov, K. S. *Nat. Mat*er. **2007**, *6*, 183-191.

S4. Casiraghi, C.; Hartschuh, A.; Lidorikis, E.; Qian, H.; Harutyunyan, H.; Gokus, T.; Novoselov, K. S.; Ferrari, A. C. *Nano Lett.* **2007**, *7*, 2711-2717.