Supplementary Information

Highly Ordered Large-Scale Neuronal Networks of Individual Cells – Towards Single Cell to 3D-Nanowire Intracellular Interfaces

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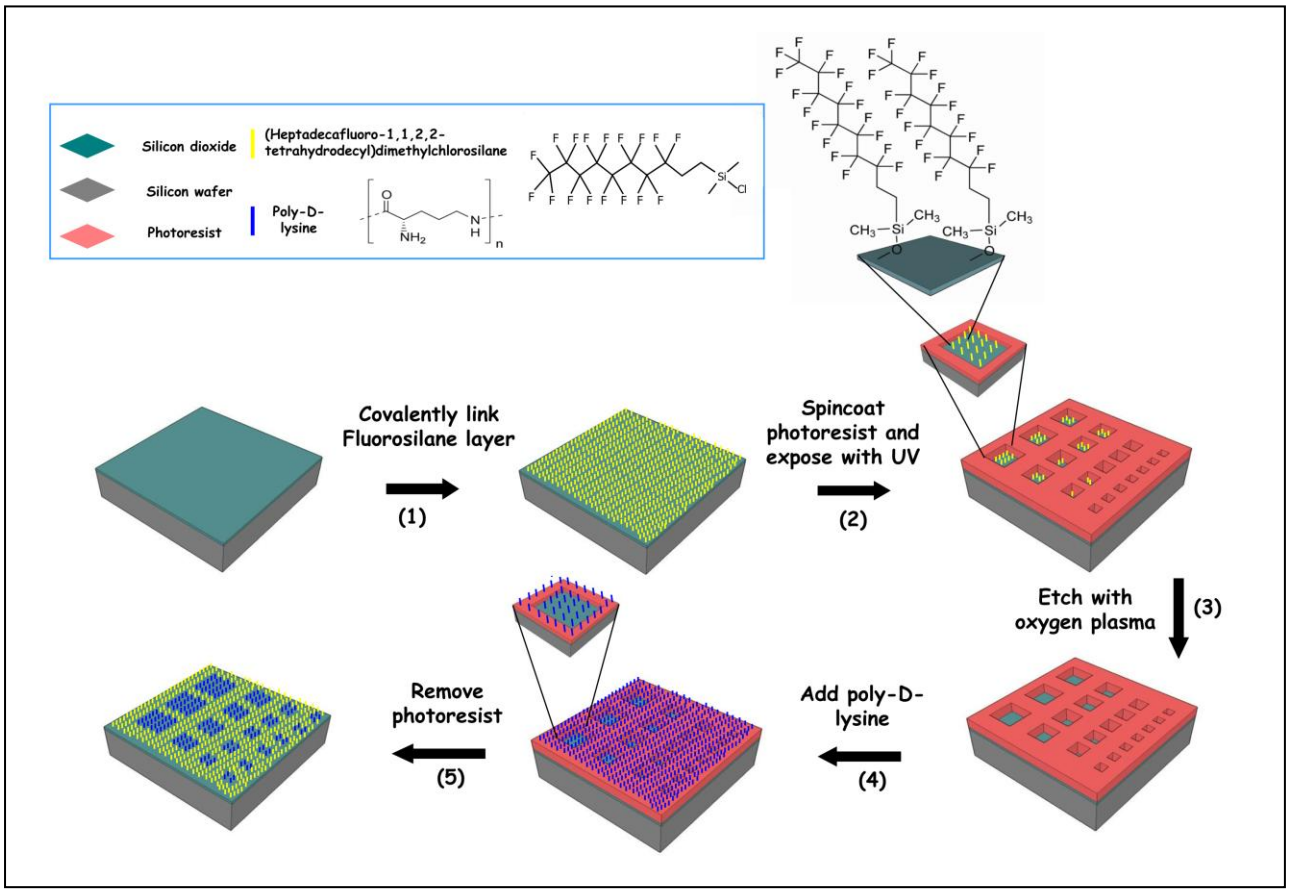

Figure S1

Schematic of the chemical surface modification, including: (1) Hydrophobic fluorosilane surface modification for neuronal cells repulsion. (2) The formation of squares pattern by photolithography. (3) Peeling of the hydrophobic layer from the square regions by a plasma treatment. (4) Full coverage with poly-D-lysine for cells attachment. (5) Removal of photoresist for the formation of chemical pattern of polylysine squares surrounded by hydrophobic fluorosilane layer.

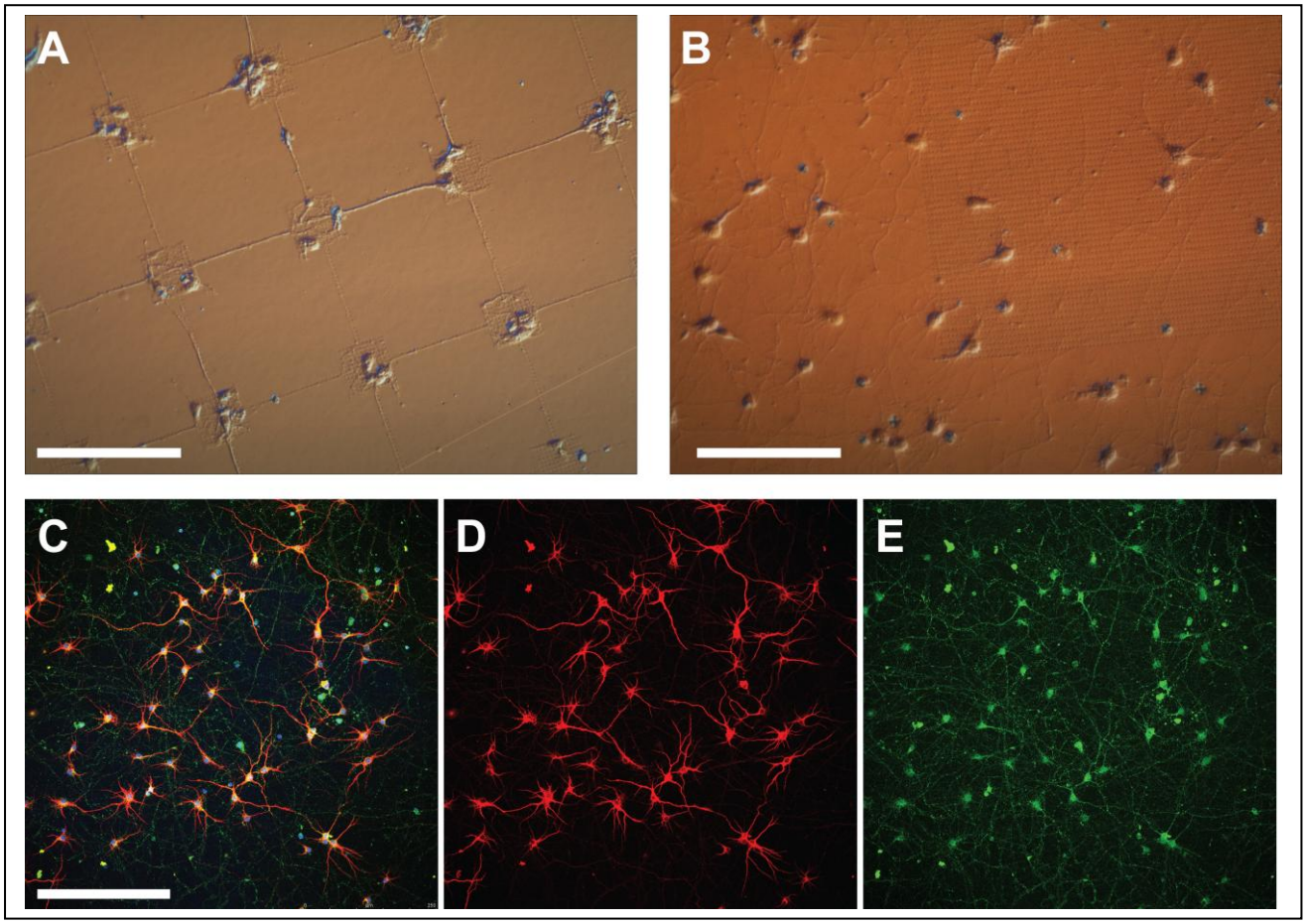

Figure S2

Cortical neuronal cells, glia free, grown on Si pillars (70-100 nm diameter, 1 µm height and 4 µm spacing). (A) Live optical image of 6 days old culture network grown on chemically modified pillars according to their guidance. Scale bar is 100 µm. (B) Live optical image of 10 days old culture spontaneously grown on Si wafer partially fabricated with pillars and fully coated with Poly-D-lysine. Both parts of the wafer, with and without pillars, present similar intact neuronal morphology. Scale bar is 100 µm. (C-E) Confocal microscope images of 10 days old culture grown on pillars

exhibiting normal morphology, labeled with MAP-2 for dendrites (red), Synaptophasin for synapses (green) and DAPI for nucleus (blue). Scale bar is 250 µm.

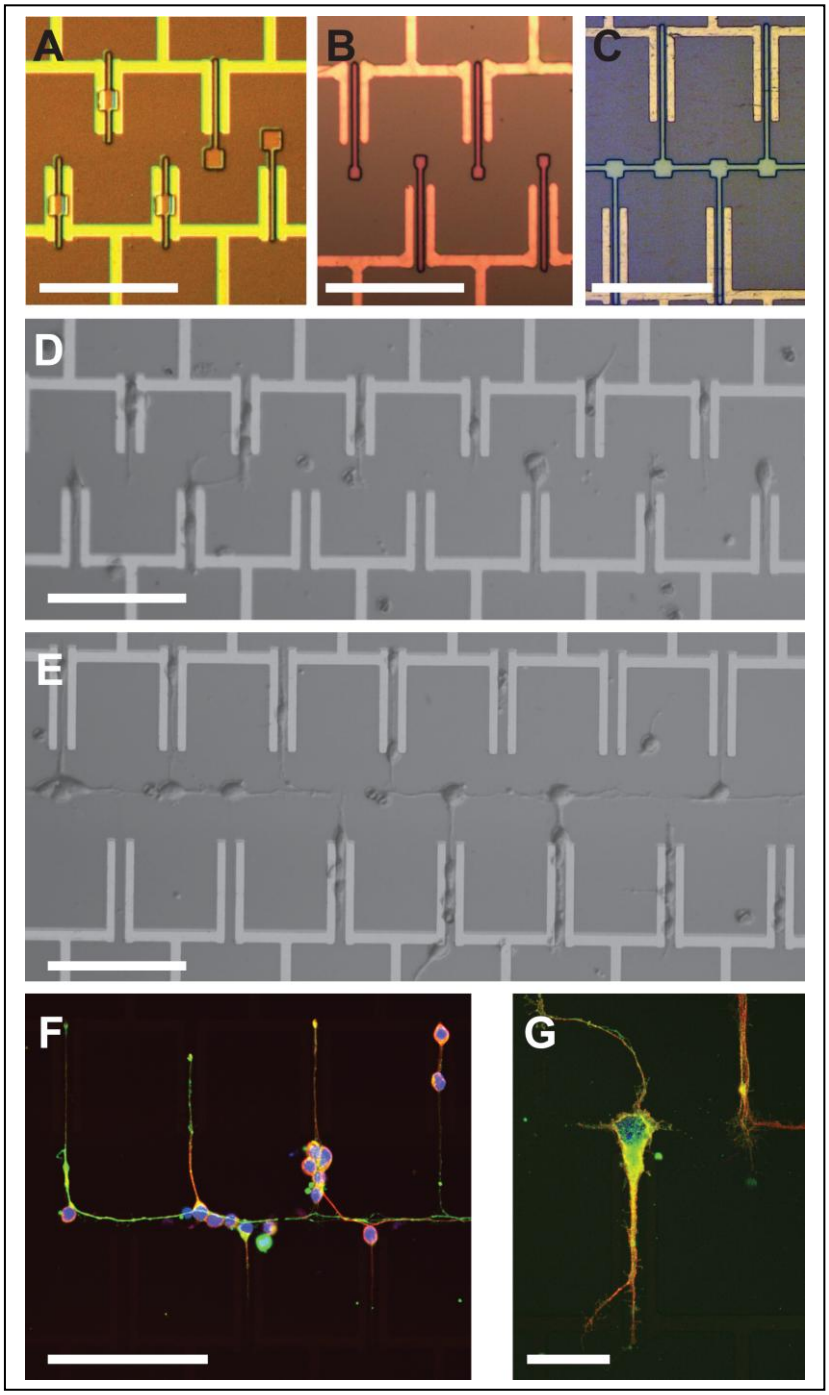

Figure S3

Controlled neuron growth, glia free, on SiNWs-FET devices in different configurations according to chemical guidance of fluorosilane and polylysine. (A-C) Different configurations for cells attachment with (A) square for soma located between or outside the source-drain (sd) electrodes, (B) smaller square for improving

the chances for attachment of single cell outside the sd electrodes and (C) pattern for attachment of a network. Scale Bars for (A-E) are 75 µm. (D) Cells grown according to the chemical pattern shown in (A). (E) Cells grown according to the chemical pattern shown in (C). (F-G) Confocal microscope images of 5 days old culture grown on the devices where dendrites are labeled with MAP-2 (red), axons labeled with TAU (green) and nucleus labeled with DAPI (blue). Scale bars are 75 µm and 25 µm, respectively."