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Supplementary Information

Continuous Electrochemical H_2O_2 Delivery for Cancer Cell Treatment

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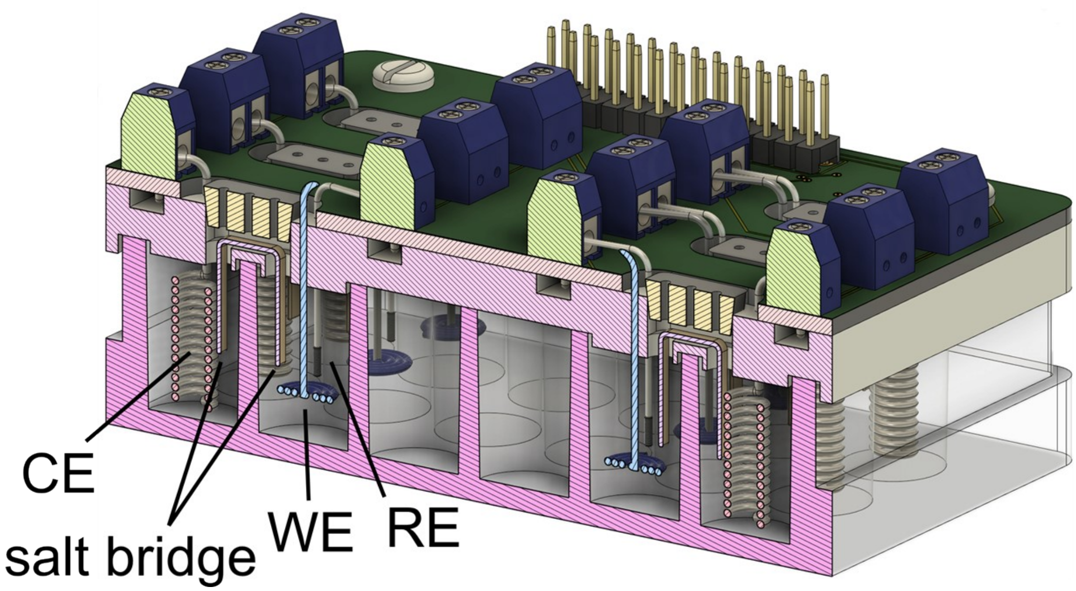
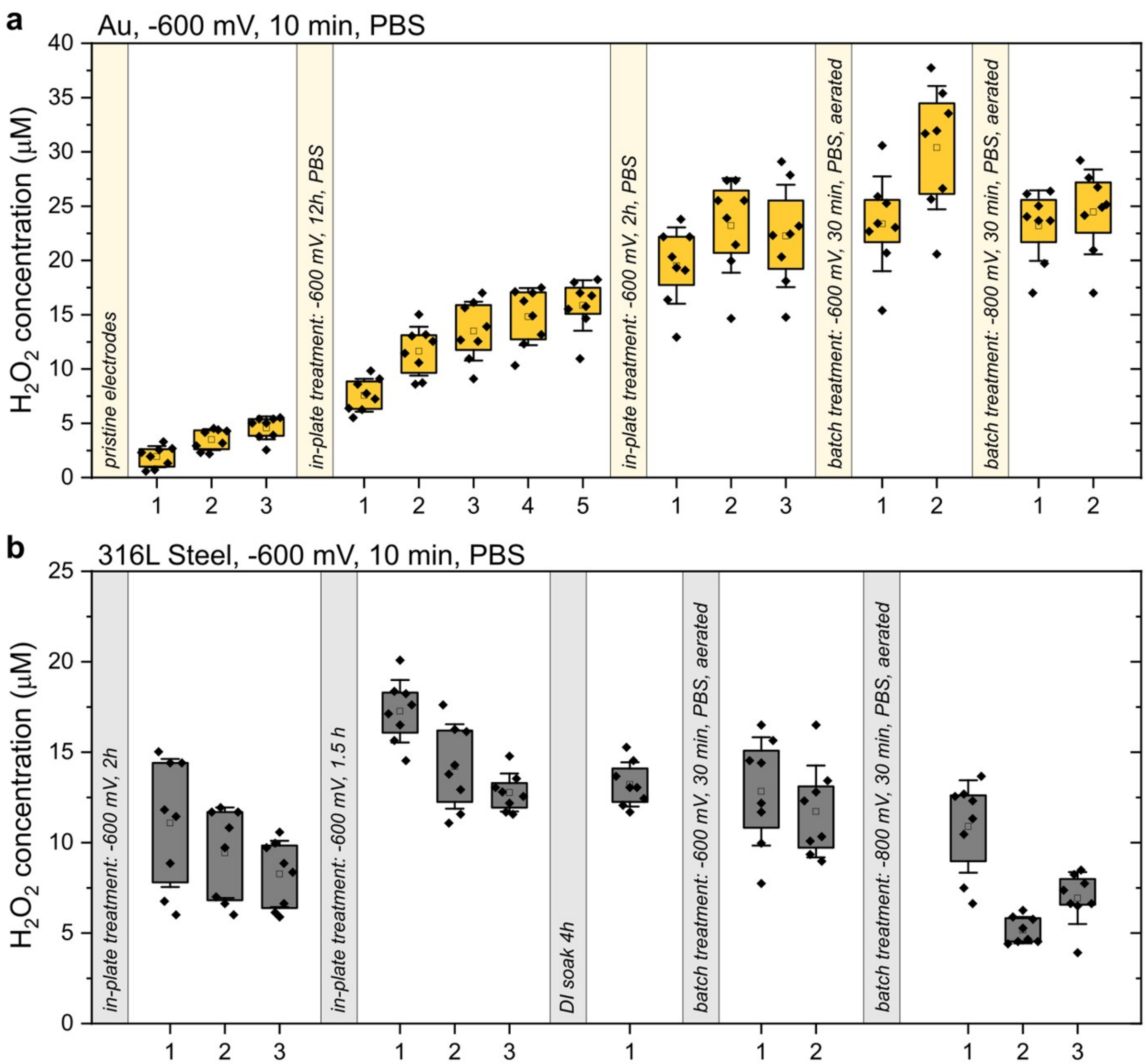
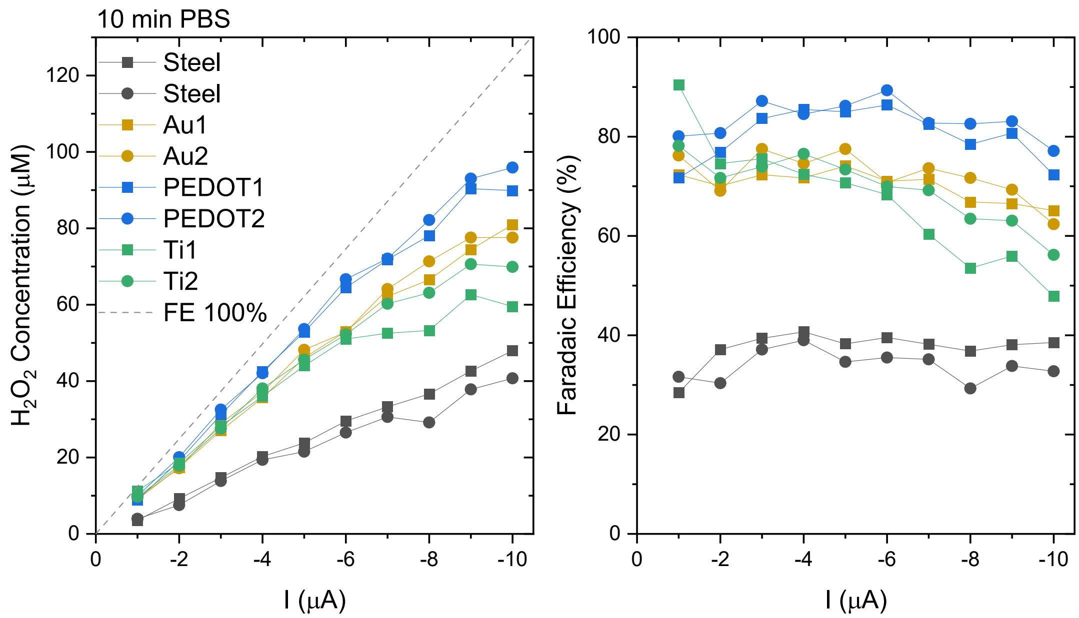


Supplementary Figure 1. Cross-sectional model of the custom multichannel electrochemical platform for *in situ* H_2O_2 generation. The platform replaces the lid of a 96-well plate and integrates all key components for electrochemical H_2O_2 generation: working, counter, and reference electrodes, and a salt bridge linking neighboring wells in an H-cell configuration. Metal wire electrodes are inserted from the top and connected via screw terminals to a PCB interfacing with an 8–16 channel potentiostat. Salt bridges are covered with plugs to prevent drying during long-term experiments.

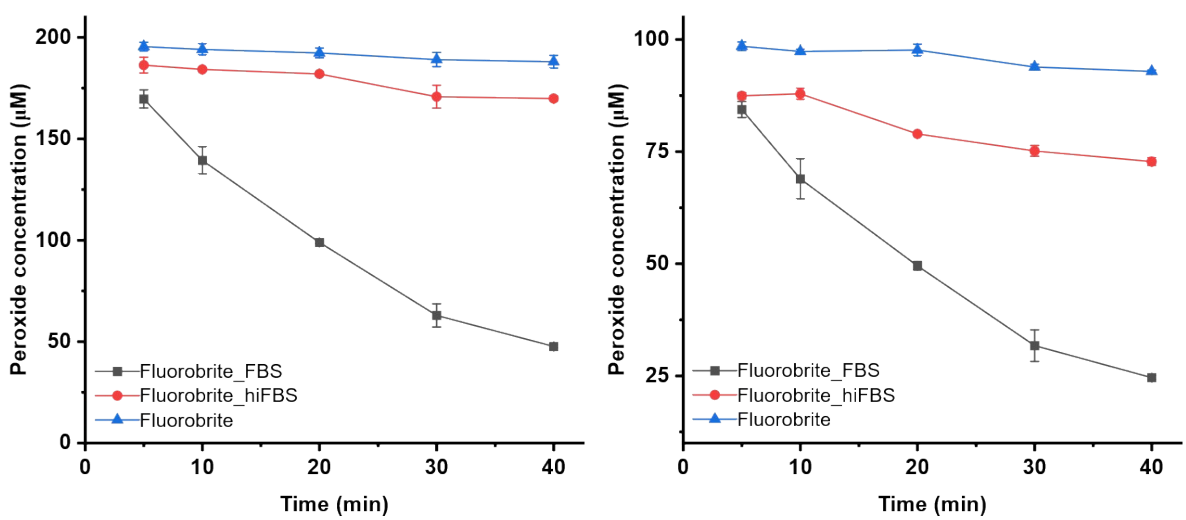


Supplementary Figure 2. Conditioning effects on Au and Steel 316L. Influence of conditioning treatments on H_2O_2 generation using gold (a) and stainless steel (b) electrodes. Each box plot represents a single measurement (x-axis = number of subsequent experimental run) of H_2O_2 generation at -600 mV vs. Ag/AgCl in PBS for 10 minutes, following the conditioning treatments specified along the vertical axis. The treatments include "in-plate" configurations, where individual working electrodes were paired with separate counter electrodes and connected via a salt bridge as in the main experimental setup, and "batch" configurations, where all working electrodes were shorted and operated against a single large platinum counter electrode in a larger, aerated vessel. Consecutive measurements after a single conditioning treatment are shown where applicable, demonstrating the (ir)reproducibility and effects of the treatment over time. Variability in H_2O_2

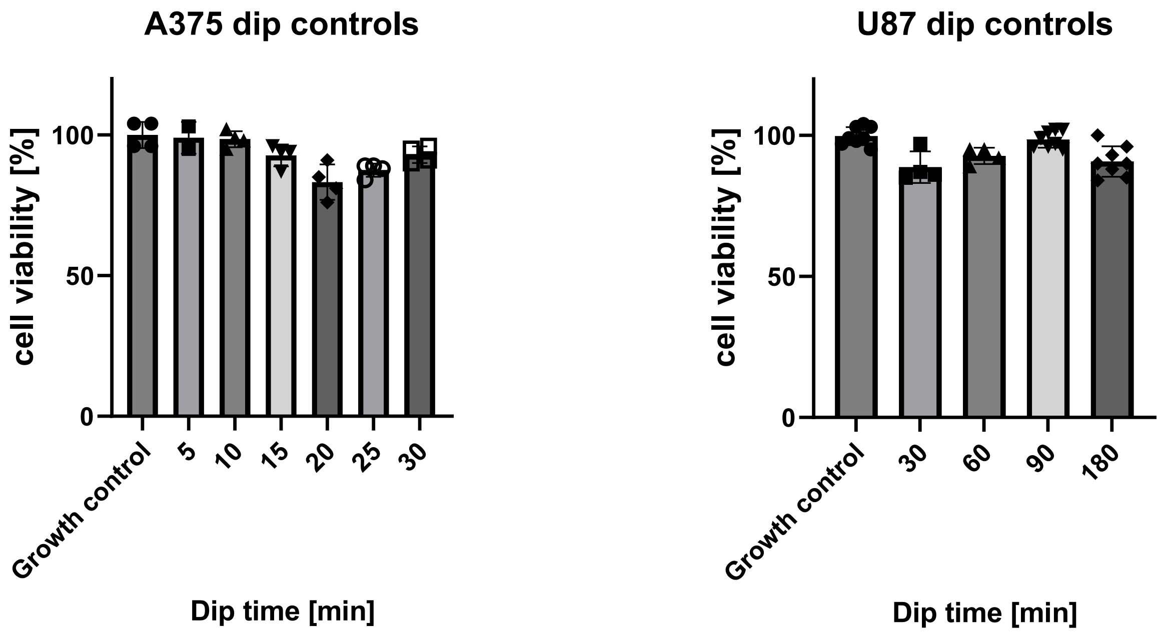
generation across treatments highlights the impact of both electrode material and conditioning method on electrochemical performance.



Supplementary Figure 3. Galvanostatic H_2O_2 generation. H_2O_2 concentrations (left) and Faradaic efficiencies (right) for 2 electrodes of each material. Currents from -1 μA to -10 μA were applied for 10 min in PBS. PEDOT exhibits the highest Faradaic efficiency of all tested materials.



Supplementary Figure 4. Scavenging of hydrogen peroxide in culture medium. Stability of externally added hydrogen peroxide in FluoroBrite medium, FluoroBrite with 10% heat-inactivated FBS (hiFBS), and FluoroBrite with 10% active FBS. Two initial concentrations of H_2O_2 were tested (200 µM, left; 100 µM, right). Active FBS caused rapid degradation of H_2O_2, while hiFBS had a moderate effect and pure medium showed minimal scavenging. Data represent mean ± SD (n = 3).



Supplementary Figure 5. Sham control experiments. The graph shows the cell viabilities in A375 and U87 for the corresponding operation time periods (5-30 min for A375, 30-180 min for U87) and compares them to growth controls that were not in touch with the PEDOT platform. The cell viability is not affected by the PEDOT platform and its components when it is disconnected.