

Electrochemical Detection of Single Cancer and Healthy Cell Collisions on a Microelectrode

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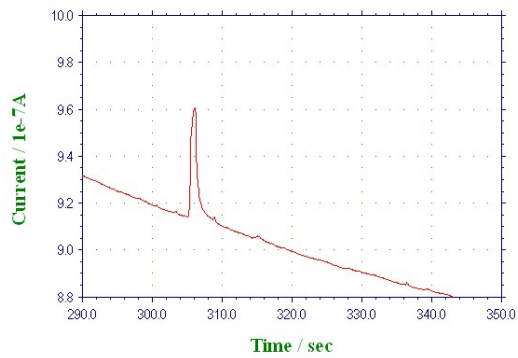
I. Methods:

Chemicals: Triton-X 100 and RPMI media were purchased from Sigma Alrdich and used without further purification.

Electrochemistry: Electrochemical experiments were performed using a CHI model 900B potentiostat (CH Instruments, Austin, TX). The three-electrode cell was placed in a faraday cage and grounded to a pipe. A Ag/AgCl (1M KCl) wire was used (BASi, West Lafayette, Indiana) as the reference electrode, and a Pt wire, tungsten rod, or graphite rod were used as the auxiliary electrode. The microelectrode was fabricated by sealing a 50 micrometer gold wire in a borosilicate capillary. Contact was made using silver epoxy, and the electrode was polished until the active surface of the microwire was exposed. Electrodes were polished using alumina slurry followed by diamond paper. Upon receipt of the cells, which were suspended in RPMI media (vide infra), the three electrodes were placed into a vial containing the cells. Amperometric current-time transients were recorded in RPMI, RPMI + Cells, and finally RPMI + Cells + TX100. The cells were allowed to freely diffuse to the electrode surface. The controlled potential amperometry was carried out at -0.9 V vs. Ag/AgCl. The collection rate was 1 point per 50 ms.

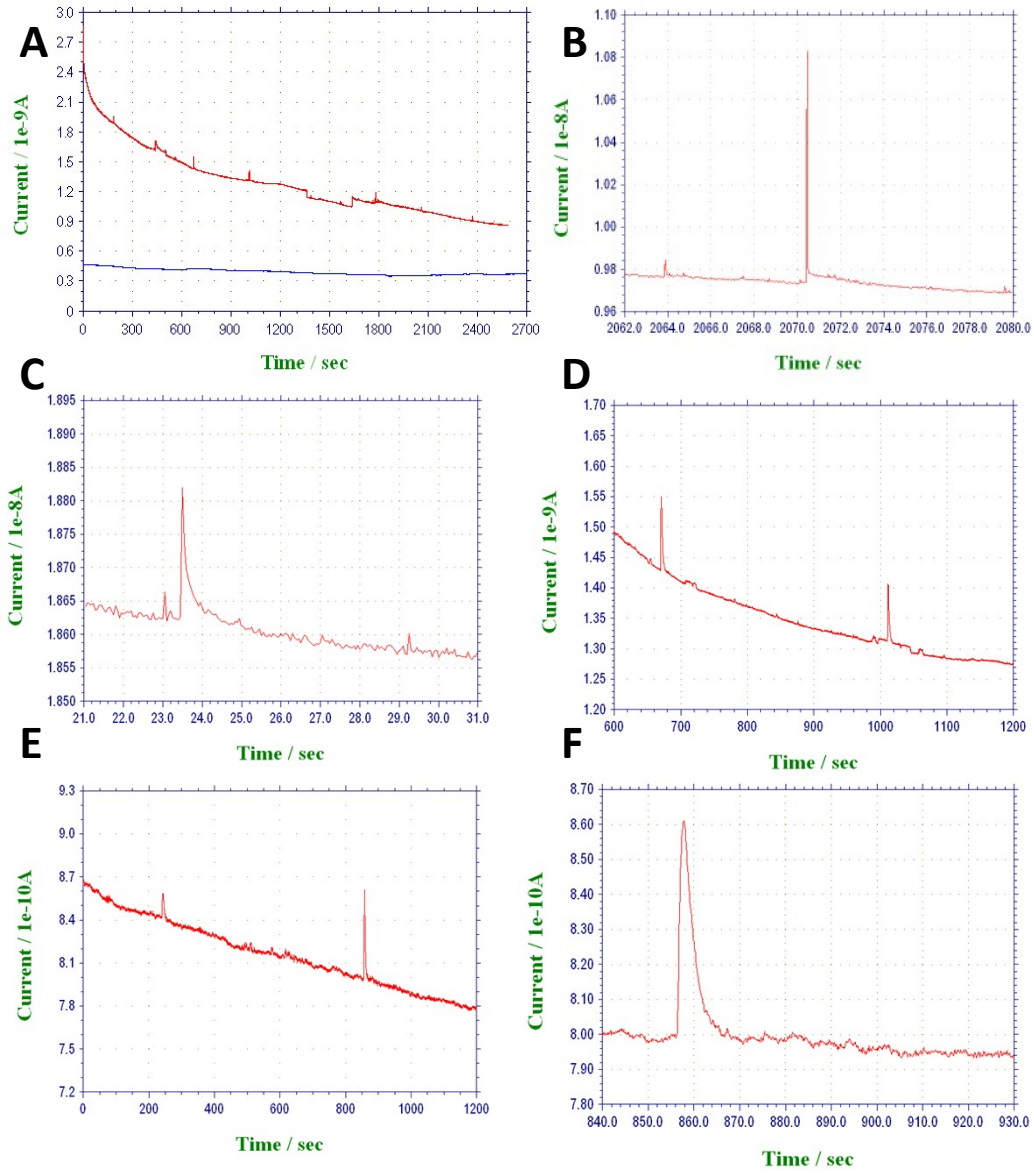
Lymphocyte extraction: LN3 mice (C57BL/6 background) and CD11c-EYFP mice (originally from Jackson Labs, Bar Harbor, ME) were provided by Lauren I. R. Ehrlich (University of Texas at Austin). LN3 mice were monitored daily and euthanized upon lymphoma detection. All mice were bred and housed under specific pathogen-free conditions at the University of Texas at Austin. Experimental procedures were approved by the Institutional Animal Care and Use Committee at UT Austin, and were performed according to the National Institutes of Health Guide for the Care and Use of Laboratory Animals. Lymphoma and control thymocytes were isolated by pressing excised thymuses through a 0.45 μm filter. Cells were then suspended in 10 milliliters of complete RPMI. Complete RPMI consisted of RPMI 1640 medium supplemented with non-essential amino acids, 2mM L-alanyl-L-glutamine, 100U/ml penicillin, 100 μg /ml streptomycin (all from Gibco), 292 μg /ml glutamine, 1mM sodium pyruvate, 10% fetal bovine serum (Hyclone, Thermo Scientific), and 50 μm β -mercaptoethanol.

II. Example of Large Blip



II. Figure S1. Example of a large blip observed in the i - t response for cancerous T cells after lysing. Amperometry was recorded on an 80 μm Pt microelectrode biased at -0.9 V vs. Ag/AgCl.

III. Extra Examples of Cell Collision Response:



Panels A-D represent collisions of T-ALL cells, while panes E-F represent collisions of healthy cells.

IV. CV Examples on a gold macroelectrode and microelectrode

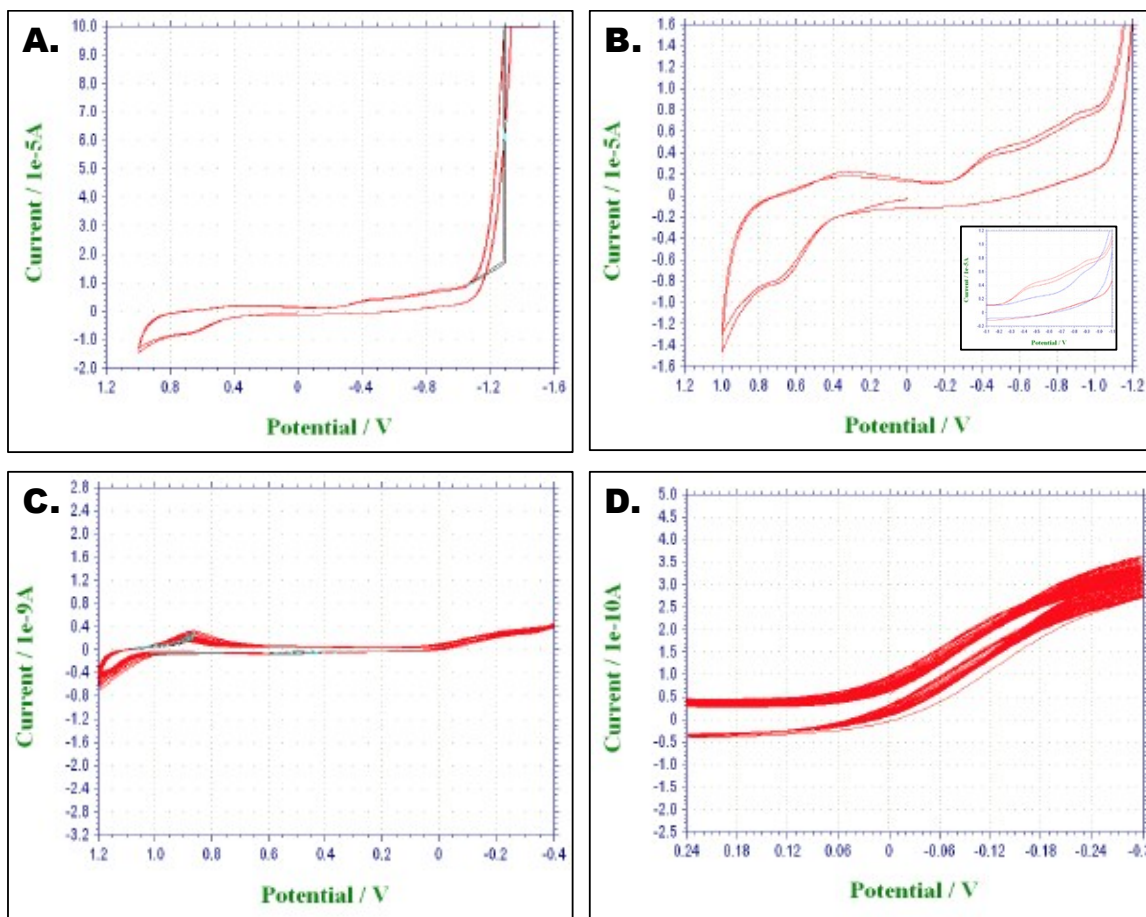


Figure S3 represents various cyclic voltammograms during the experiments with cancerous cells. A.) CV on a polycrystalline gold electrode ($r = 1.5$ mm) in the presence of 0.2 mM TX100 and T-ALL cells. B.) Enlargement of A. Inset represents the effect of increasing concentration of T-ALL cells on the magnitude of the peaks. The anodic peak at 0.7 V represents gold oxidation, and the cathodic peak at 0.35 V represents the subsequent reduction of the oxide. The peak at -0.42 is assigned to oxygen reduction, and the peak at -0.93 is assigned to contents within the cell. C.) and D.) are microelectrode experiments in RPMI media. In the experiments with higher concentrations of TX100 (capable of lysing the cells), it was found that non-specific adsorption quickly deactivated the UME surface. Thus, only oxygen reduction is found in the background experiments without cells.