Supplementary Information for

Porous microneedle-based electrochemical aptamer biosensor for collection and quantitative analysis of dry eye disease biomarkers

Eira Beryle Ko#, Tianli Hu#, Ya Zhang, Xueyan Wang, Yu Song*, Chenjie Xu*

a. Department of Biomedical Engineering, College of Biomedicine, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon Tong, Hong Kong SAR, P. R. China

#These authors contributed equally

*Correspondence: yusong@cityu.edu.hk (Y.S.), chenjie.xu@cityu.edu.hk (C.X.)

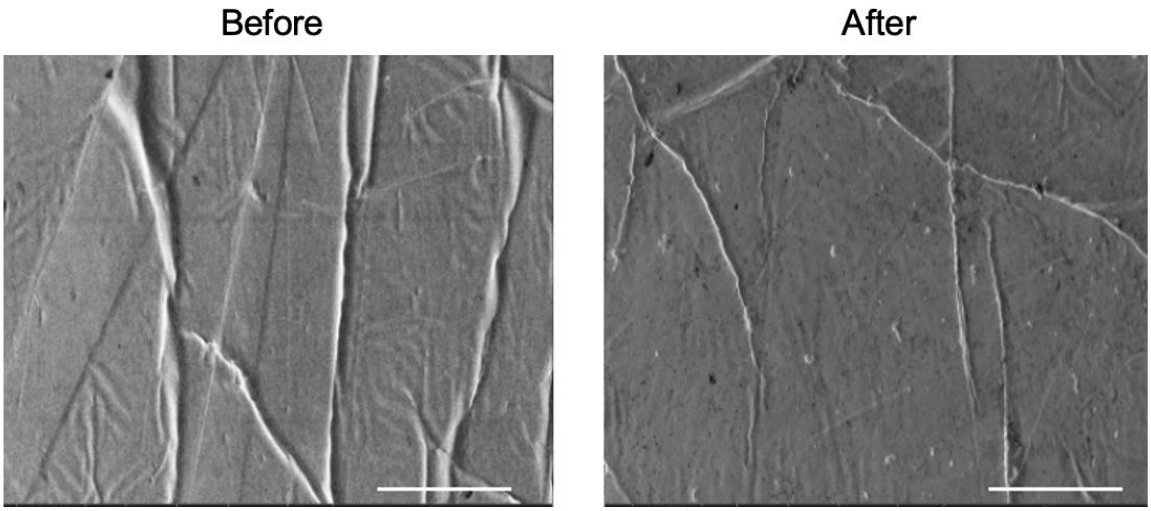

Figure S1. SEM of WE before and after electrochemical measurement with target (MMP-9), scale bar: 50 μm.

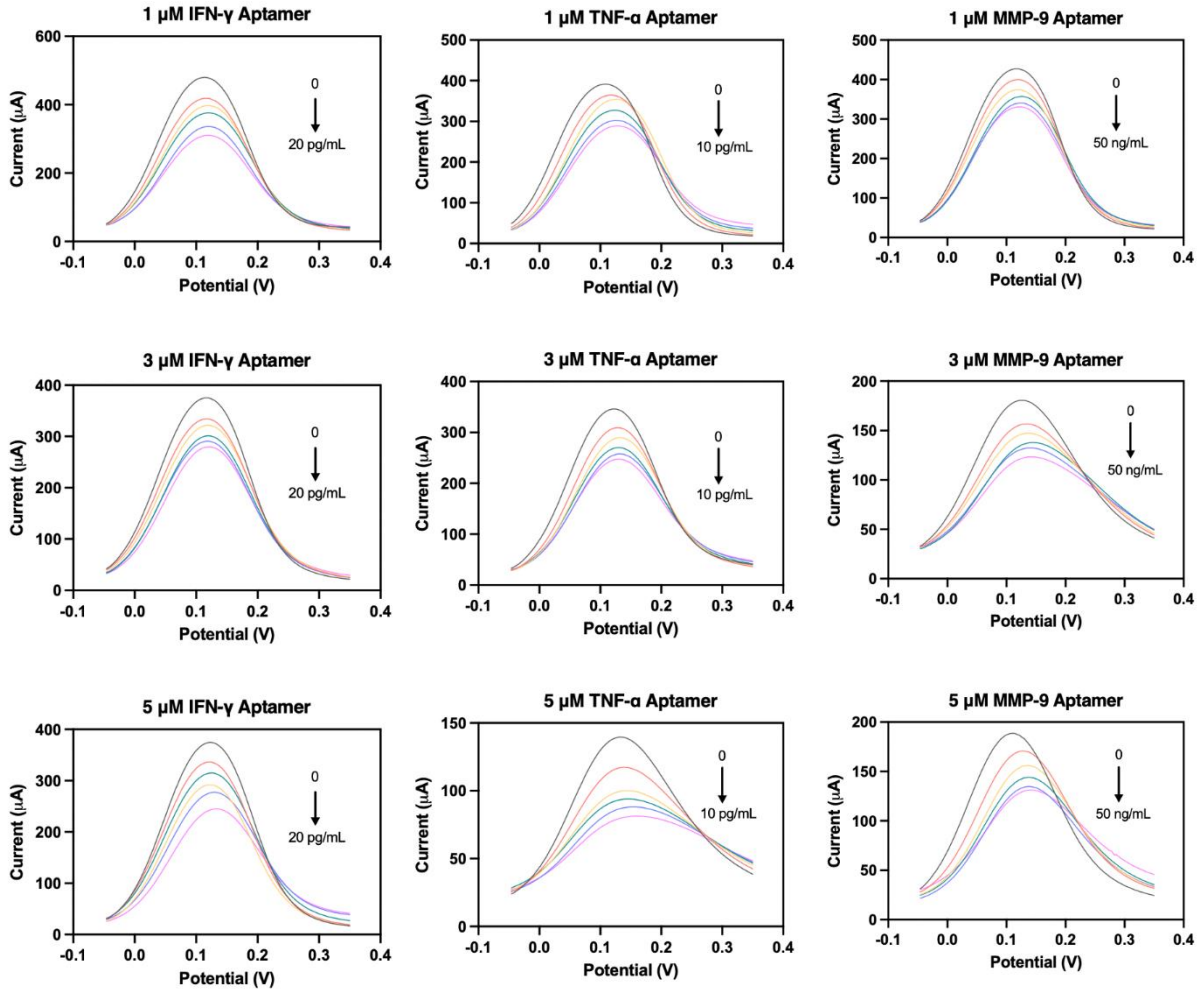

Figure S2. SWV responses of 1, 3, and 5 µM aptamers in 0-20 pg/mL IFN-γ, 0-10 pg/mL TNF-α, and 0-50 ng/mL MMP-9.

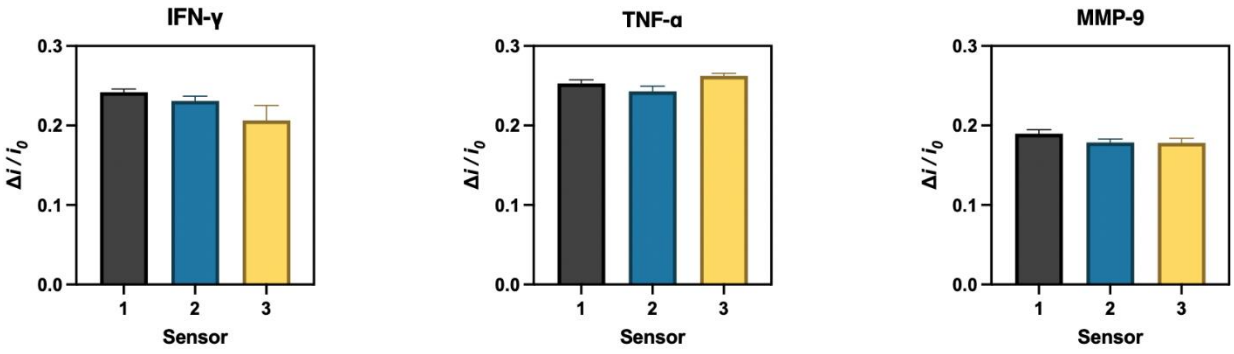

Figure S3. Reproducibility of IFN-γ, TNF-α, and MMP-9 sensors in 5 pg/mL IFN-γ, 0.5 pg/mL TNF-α, and 20 ng/mL MMP-9 respectively.

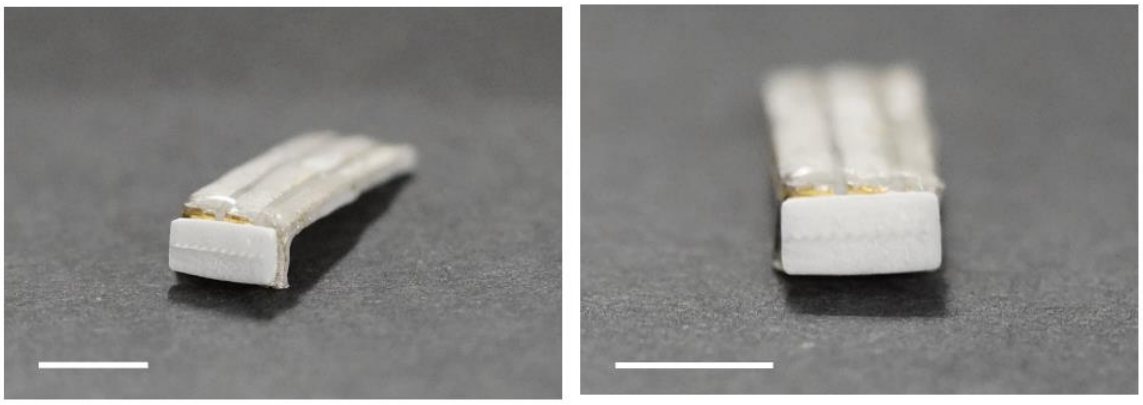

Figure S4. Digital images of the device with MN and aptamer sensor, scale bar: 7.5 mm.

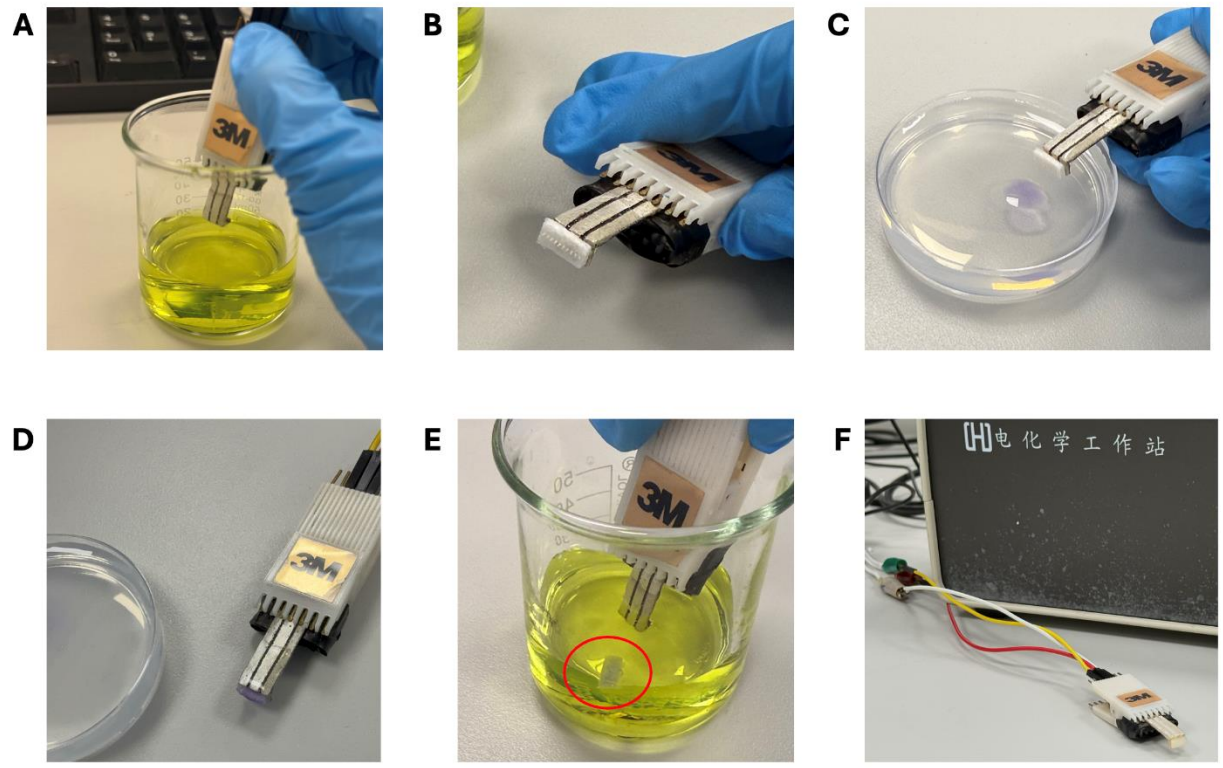

Figure S5. Demonstration of the collection-to-detection workflow *in vitro*. Digital images of (A) the baseline SWV measurement of aptamer sensor in $Fe(CN)_6^{3-/4-}$; (B) the completion of the integrated device by attaching APC-MN; (C) the collection of crystal violet dye from hydrogel model; (D) the absorption of crystal violets dye from MN tips to base which is in direct contact with the sensing interface; (E) the detachment of MN (circled in red) from the device when immersed in $Fe(CN)_6^{3-/4-}$; (F) the set-up of device connected to the electrochemical workstation.

Supporting Video S1. Absorption of crystal violet dye from hydrogel model to APC-MN using the integrated device.

Supporting Video S2. Detachment of APC-MN from device in $Fe(CN)_6^{3-/4-}$.