Supplementary Information

3D-Printed Electrochemical Cells for Multi-Point Aptamer-based Drug Measurements

John Mack[1], Raygan Murray[1], Kenedi Lynch[2], Netzahualcóyotl Arroyo-Currás[1,2,*]

Affiliations:

[1] Biochemistry, Cellular and Molecular Biology Program, Johns Hopkins University School of Medicine, Baltimore, MD 21205, USA

[2] Amgen Scholars Program, Krieger School of Arts and Sciences, Johns Hopkins University, Baltimore, MD 21218, USA

[3] Department of Pharmacology and Molecular Sciences, Johns Hopkins University School of Medicine, Baltimore, MD 21205, USA

* Correspondence to:
Netz Arroyo, Ph.D.
316 Hunterian Building
Johns Hopkins University School of Medicine
725 North Wolfe Street
Baltimore, MD 21205
netzarroyo@jhmi.edu
443-287-4798

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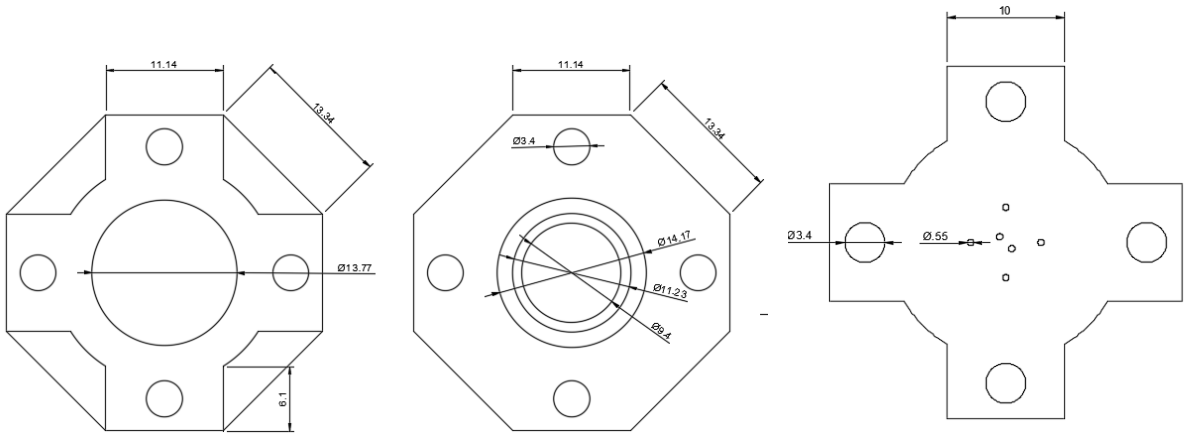

Figure S1. Technical schematic of 3D printed device

Top-down diagrams of the 3D-printed parts used in this study, including the brace (left), chamber lid (center), and electrode shell (right). Drawings made using AutoDesk Fusion360™.

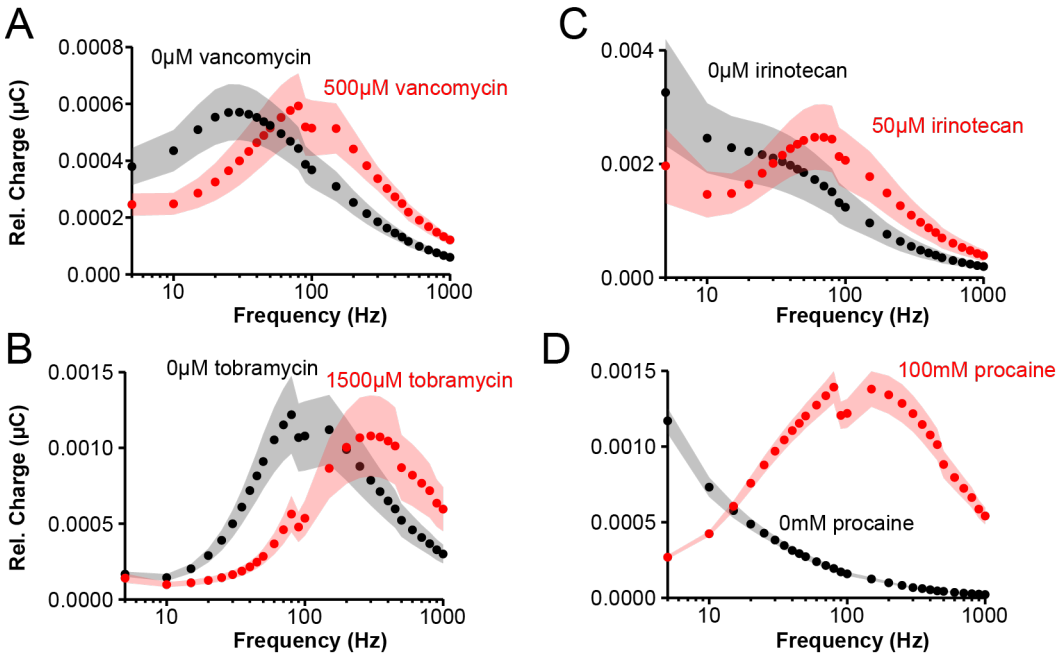

Figure S2. Sensor square wave frequency maps

Frequency maps taken with 3D-printed devices in the absence (**black**) and presence (**red**) of saturating concentrations of target. Aptamer sequences used were against: (**A**) vancomycin, (**B**) irinotecan, (**C**) tobramycin, and (**D**) cocaine. n = 4 electrodes (1 3D-printed device each), shaded regions represent standard deviation.

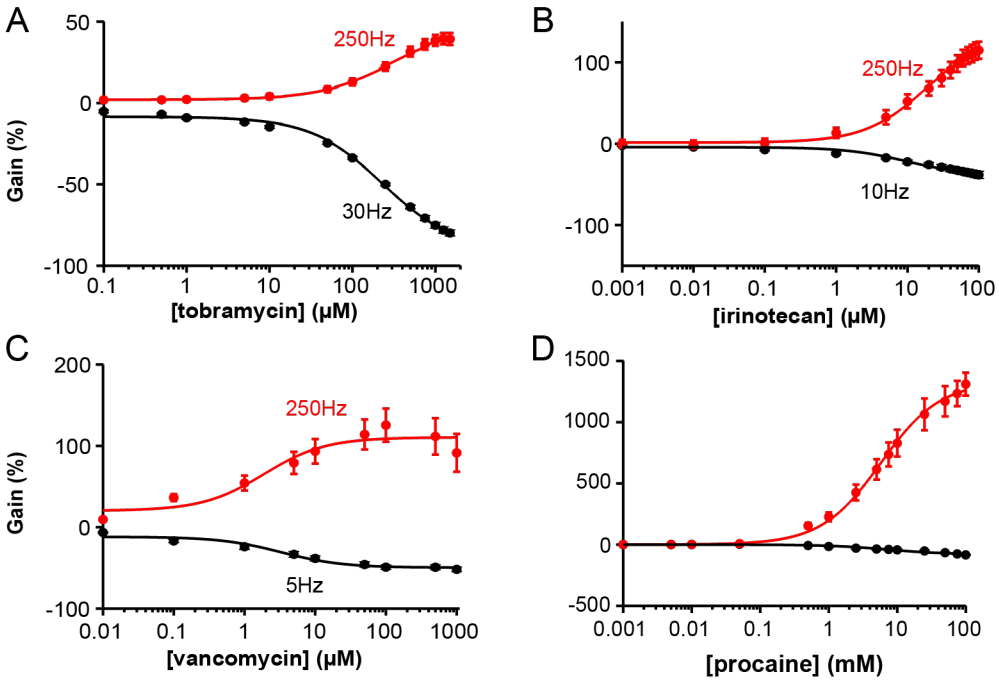

Figure S3. Dose-response curves of sensors fabricated on cMEs

Signal-on (**red**) and signal-off (**black**) curves for the following four aptamer sequences in response to increasing concentrations of their respective indicated analyte: (**A**) tobramycin (**B**) irinotecan (**C**) vancomycin and (**D**) cocaine. n = 4 cMEs, error bars represent standard deviation.

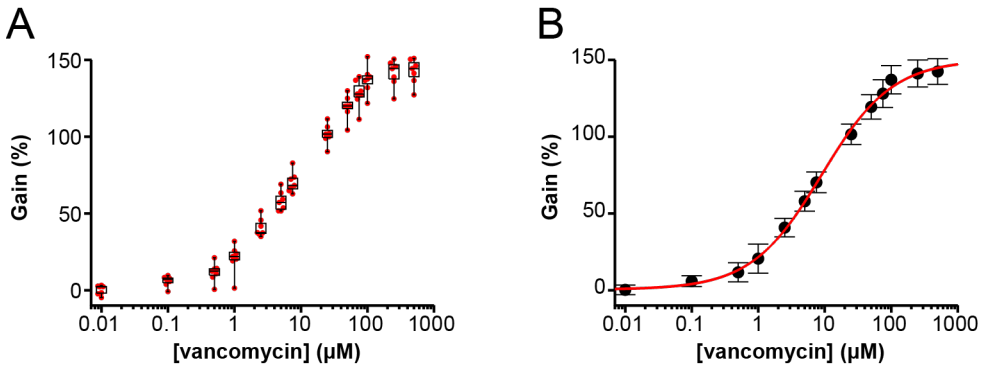

Figure S4. Vancomycin sensor calibration using roughened electrodes

(**A**) Signal gain as a function of concentration for six sensors fabricated on roughened electrodes. Each point represents the average value of four electrodes, the box represents the interquartile range, and the upper and lower whiskers represent maxima and minima. n = 6 (2 3D-printed devices, 3 electrodes each) for each concentration value. (**B**) Signal gain data from (A) plotted as single points and fit to the Hill equation by nonlinear regression (red line). Base = 0.004% ± 0.0194, max = 1.5% ± 0.03, Hill coefficient = 0.82 ± 0.05, EC_{50} =9.03 ± 0.69. Error bars represent the standard deviation of the mean.

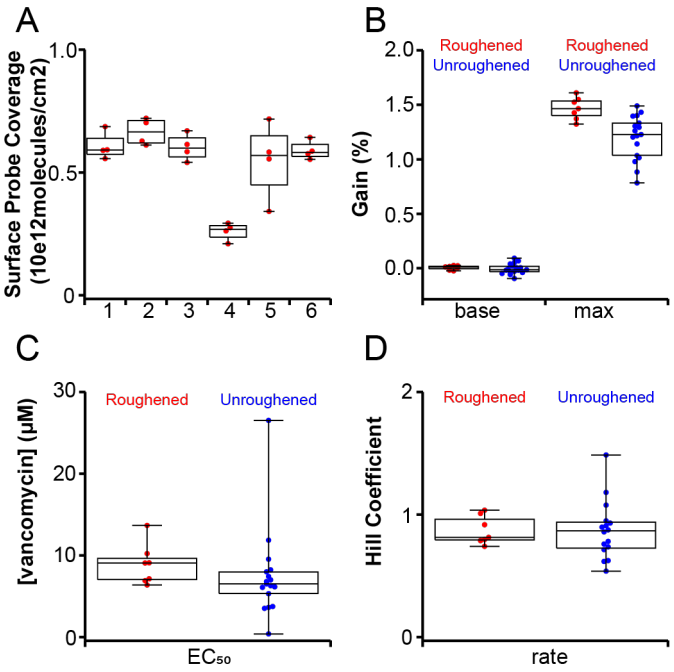

Figure S5. Parameters and aptamer density in smooth vs roughened electrodes

(**A**) Density of aptamer probes on the gold electrode surface as measured by cyclic voltammetry and integration of the area under the reduction peak. Six devices fabricated on six separate occasions. n = 4 electrodes. (**B**) Base and maximum signal gain, (**C**) EC_{50}, and (**D**) Hill coefficient as calculated by nonlinear regression to the Hill equation for each individual titration. Colored dots represent individual data points, red = roughened electrodes, blue = nonroughened electrodes. n ≥ 6 titrations. For all plots, central lines represent the median, boxes represent the interquartile range, and whiskers are maxima and minima.

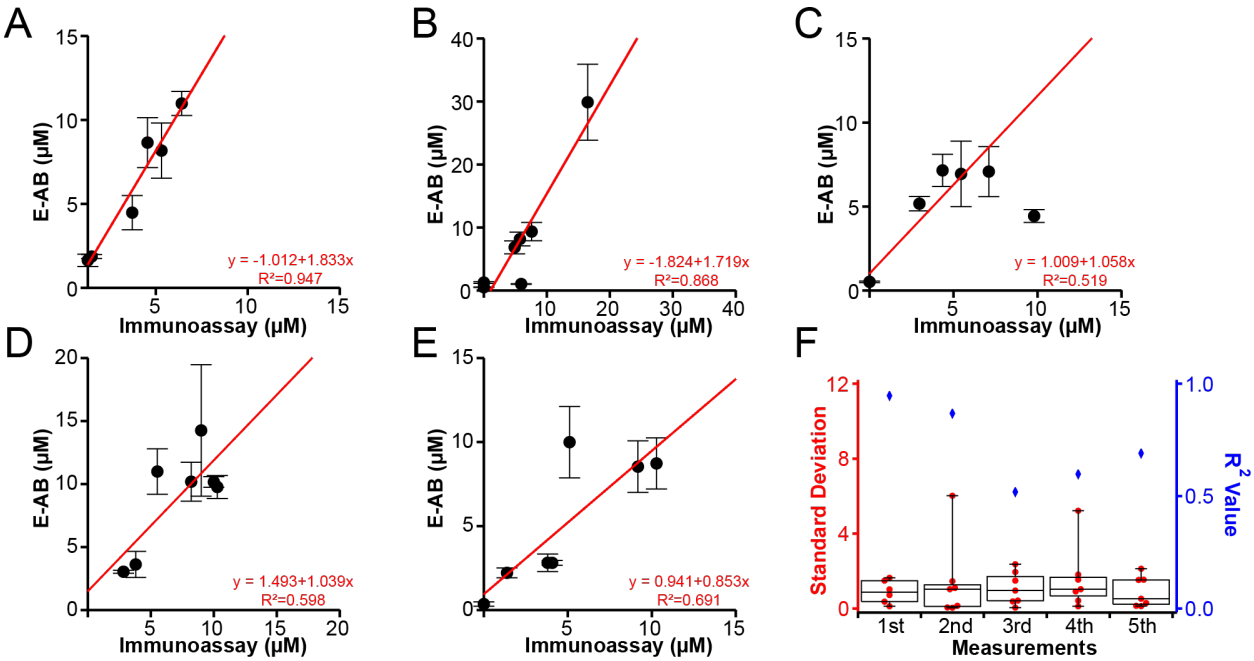

Figure S6. Breakdown of measurements in clinical samples by order number

Correlation between E-AB and immunoassay quantifications for the (**A**) first, (**B**) second, (**C**) third, (**D**) fourth, and (**E**) fifth sample measured using the same device. Dots represent individual data points; error bars represent standard deviation of n = 4 electrodes. Red line represents a linear regression. (**F**) Standard deviations for each data point (red dots) and linear regression R^2 values (blue diamonds) as a function of the data point's position in the measurement sequence. For box plots, the central line represents the data median, boxes represent the interquartile range, and whiskers represent maxima and minima. n = 6 measurements per sequence position.

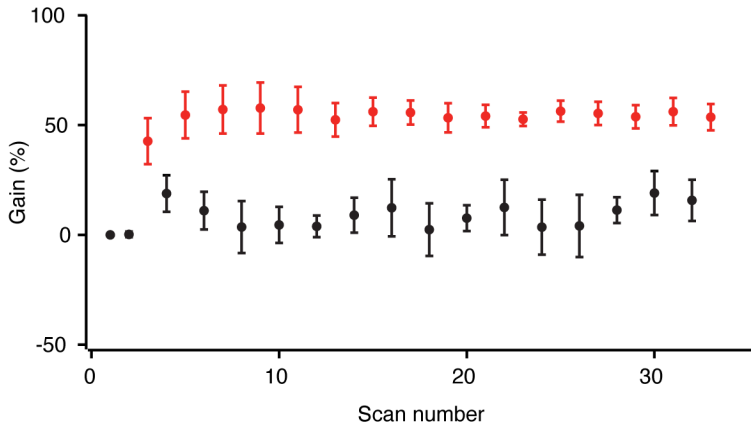

Figure S7. Response to target and baseline stability following serial urea washing.

The 3D-printed cell was functionalized with vancomycin aptamer, then serially interrogated in 100% human serum in the absence (black) or presence (red) of 10 μM vancomycin. Scans were taken every 120 seconds, and medium was exchanged immediately after scanning. Data are normalized to the first blank serum scan. Two scans were measured initially for redundancy. n = 4 electrodes, error bars represent standard deviation.