

Figure S1. Schematic of coagulation cascade that begins with vessel injury. ProThrombin converts to Thrombin, which then Thrombin amplifies the process to generate additional Thrombin, Thrombin by converting fibrinogen to fibrin (left image). Thrombin also activates ambient platelets, and induces platelet aggregation (right image).

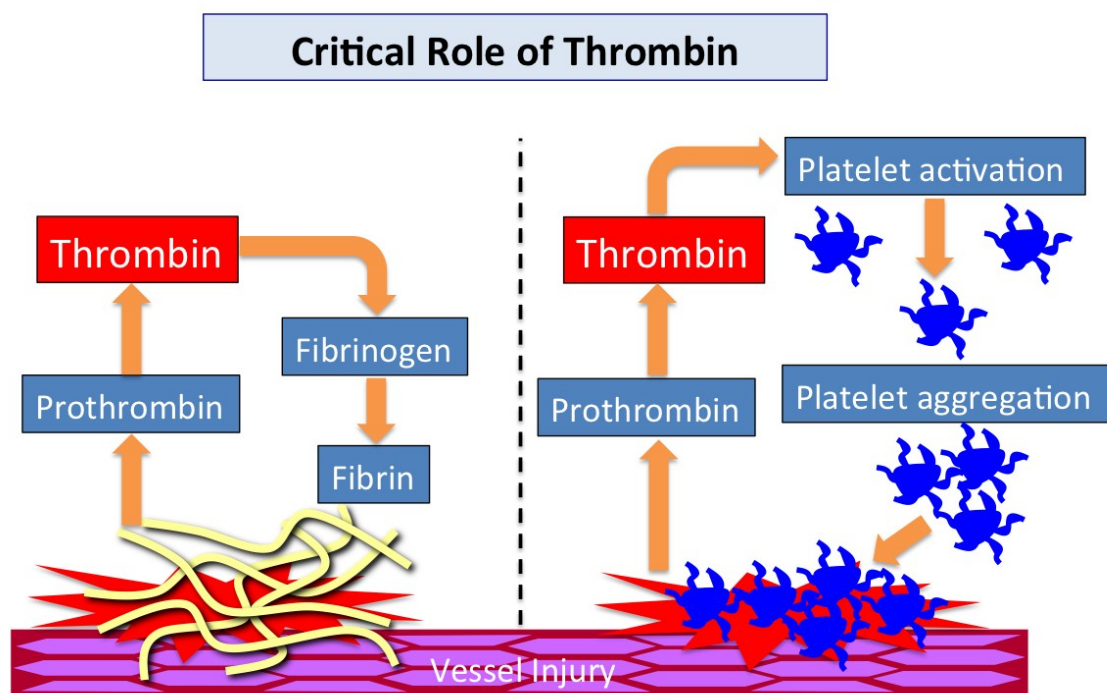
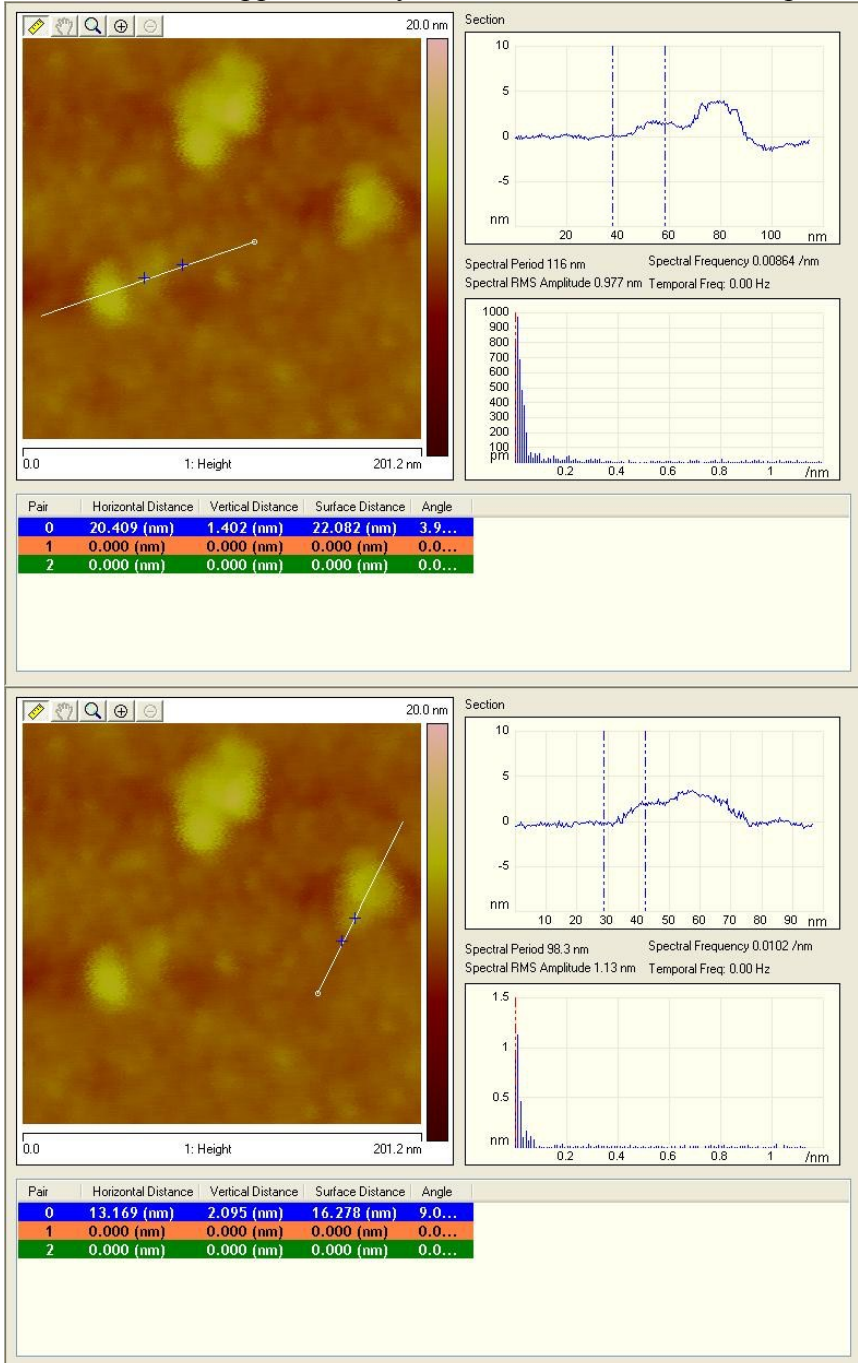


Figure S2. AFM image of a nanosheet deposited on silicon wafer with the thickness profile. Two, three, four, and five layers of MoS<sub>2</sub> were observed, the measured thicknesses were approximately 1.4, 2.1, 2.6, and 3.4 nm, respectively.



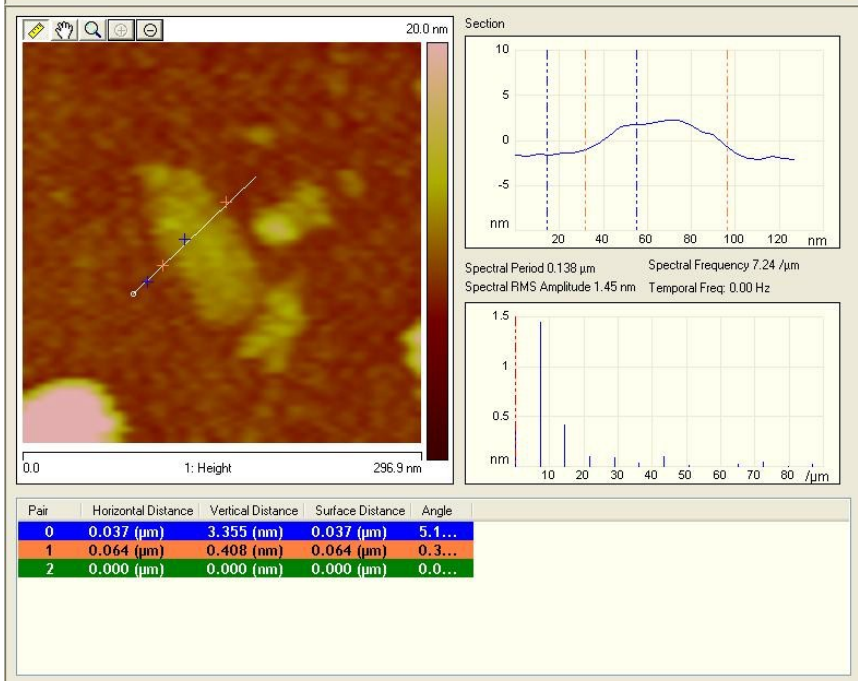
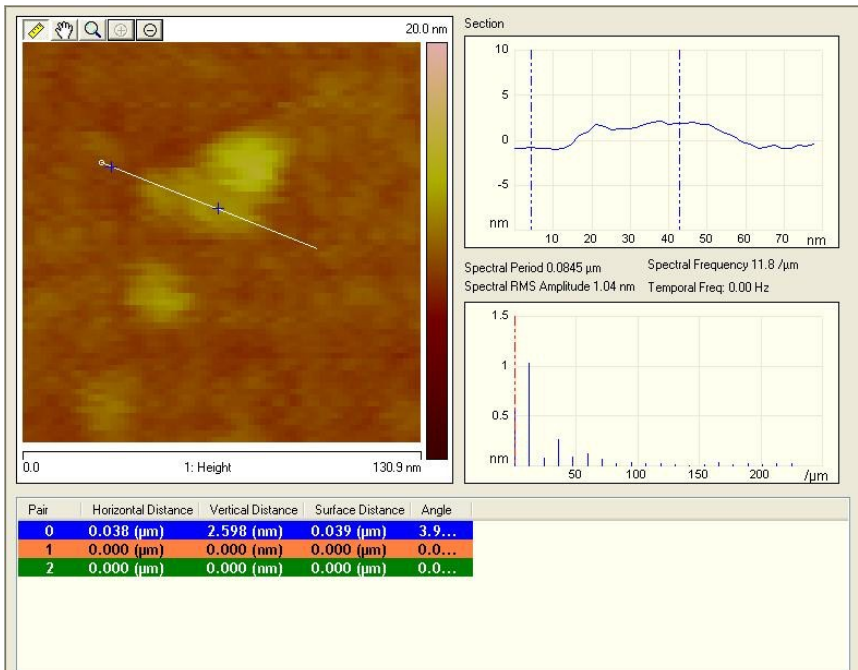
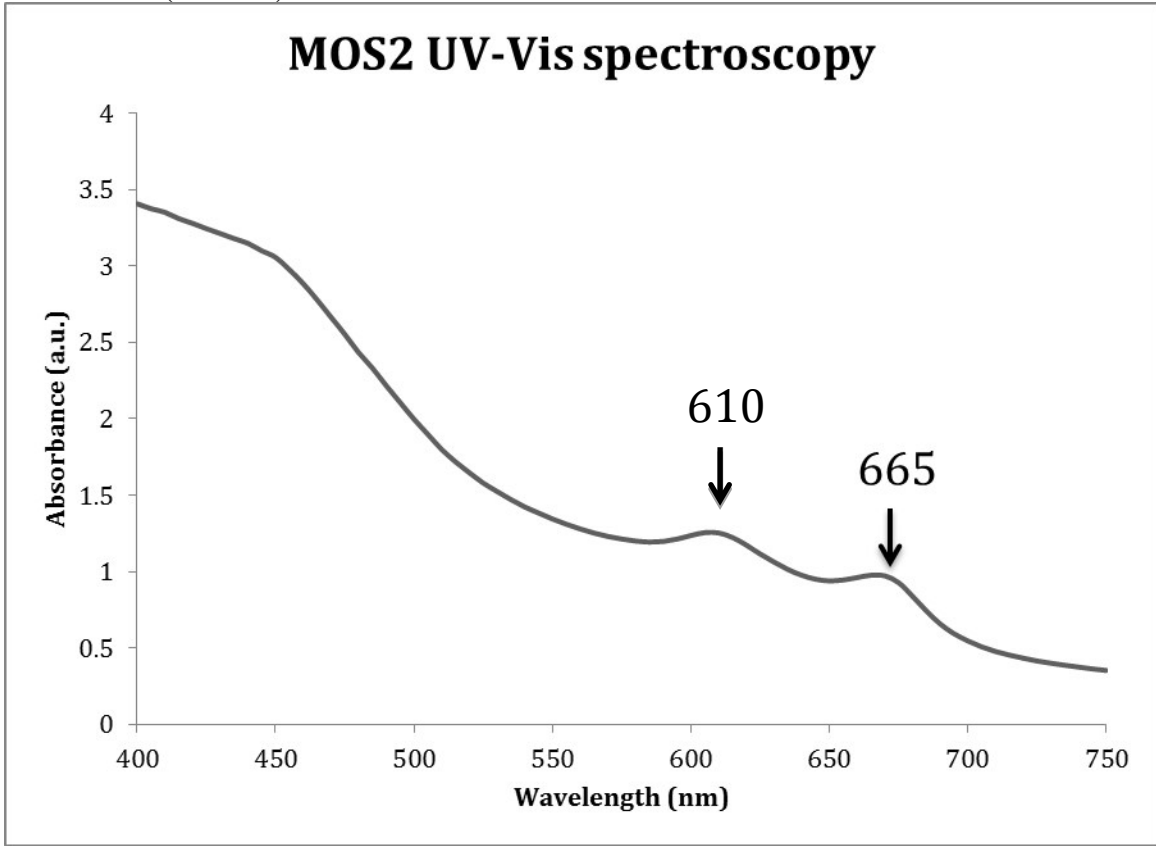


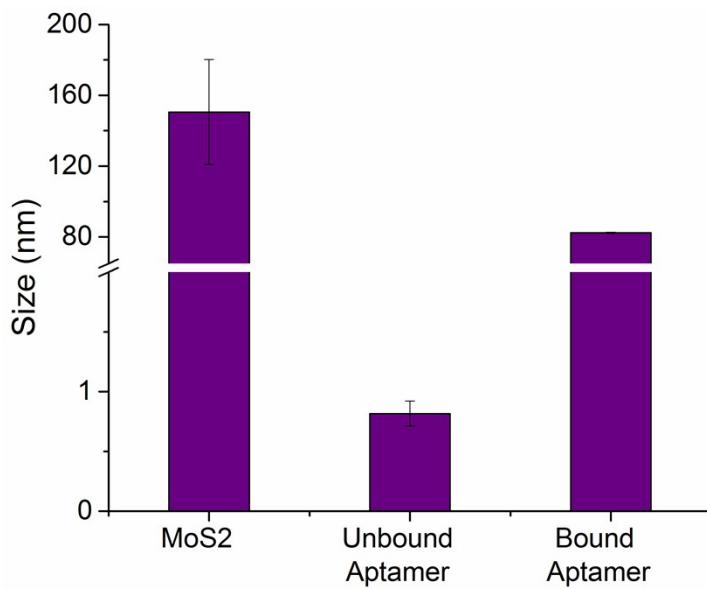
Figure S3. The UV-Vis spectrum consists of two excitonic peaks at 610 nm (1.83 eV) and 665 nm (2.03 eV).



### Size measurement using DLS

A comparison between the size of MoS<sub>2</sub>, unbound aptamer and aptamer bound MoS<sub>2</sub> measured using DLS is shown in Figure S3. It can be seen that the size of MoS<sub>2</sub> is around  $150 \pm 4.6$  nm and the unbound aptamer is approximately  $0.9 \pm 0.1$  nm. When aptamer binds to MoS<sub>2</sub>, the size decreases to around  $80 \pm 0.28$  nm. We believe that this decrease in size could be because of the separation of 2-3 MoS<sub>2</sub> nanosheets held by weak vanderwaal's forces into single layer sheets upon aptamer binding, thus resulting in single layer nanosheets for biosensing.

Figure S4 represents the size of MoS<sub>2</sub>, unbound aptamer and aptamer bound MoS<sub>2</sub>.



## Bode plot

The Bode phase plot (figure S5.1) of aptamer and Thrombin (267 pM) showed a phase lag of  $80^\circ$  which indicates the capacitive behavior of the biosensor. This capacitive behavior is consistent over the frequency range 10–5000 Hz and impedance change between aptamer and Thrombin is observed the highest SNR (signal-to-noise ratio) at 100 Hz.

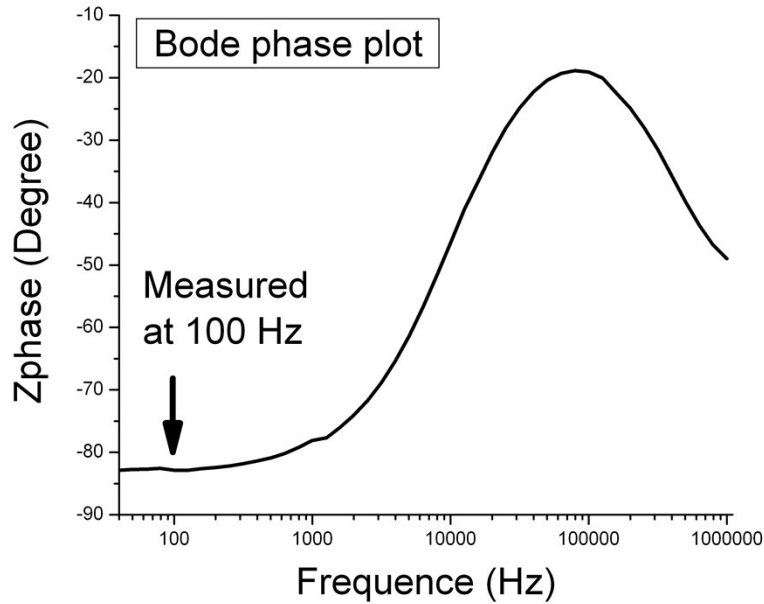


Figure S5.1 Phase Bode plot indicates the capacitive behavior of the biosensor at 100 Hz

Figure S5.2 and S5.3 show Bode impedance and phase plot of different Thrombin dose over the frequency range 100-10000 Hz. Lower than 100 Hz the measured impedance will reach close to 1 M ohm with higher noise background. After evaluation at different frequency, the 100 Hz was used because there is the highest SNR at this frequency.

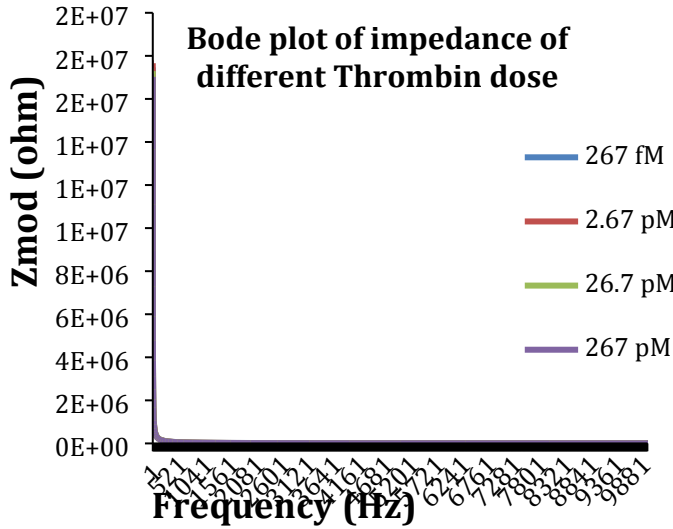


Figure S5.2 Impedance Bode plot

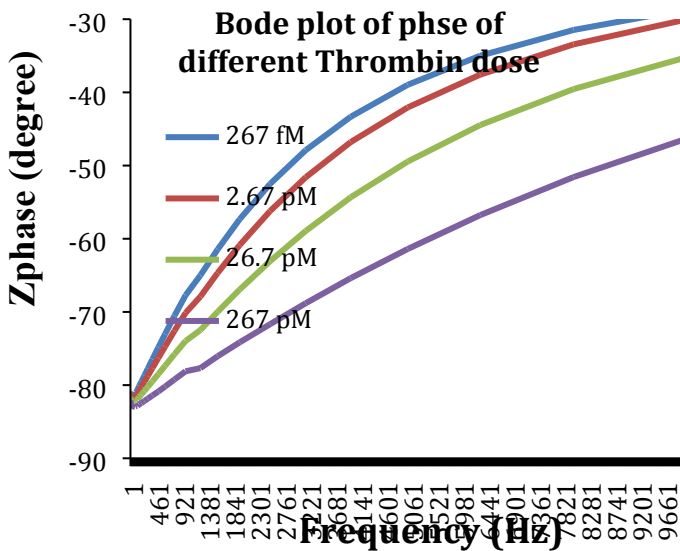


Figure S5.3 Phase Bode plot

Figure S6

Figure S6.1 and S6.2 show the impedance measurements for varying Thrombin concentration in 10% Human serum (HS). It can be observed from the HS control that the impedances increase from 262 K $\Omega$  to 273.5 K $\Omega$  for first 3 measurements. After 3<sup>rd</sup> measurement the value almost remains constant at ~270.5 K $\Omega$  - 275 K $\Omega$ . Figure S5.2 shows the impedance measurements for Thrombin from 0.0267 pM to 267 pM in 10% HS. The impedance increasing for dose 0.0267 pM to 26.7 pM indicates no thrombin binding to aptamer (which would cause impedance decrease), and suggesting other proteins adsorb on the electrode surface. A slight decrease in impedance of about 4.7 K $\Omega$  at 267 pM was observed. However, this change was very low as compared to the signal change observed in 1% HS and thus, validates the choice of 1% HS for analysis. Figure S5.3 also shows the impedance measurements of 1% HS control.

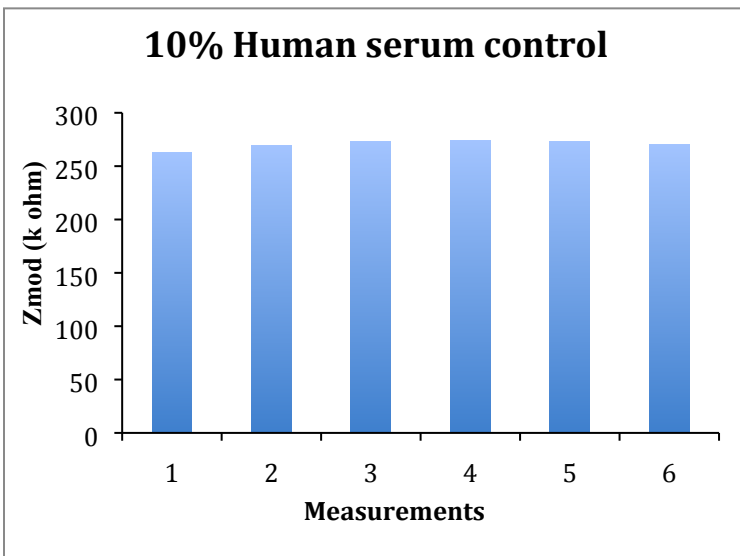


Figure S6.1

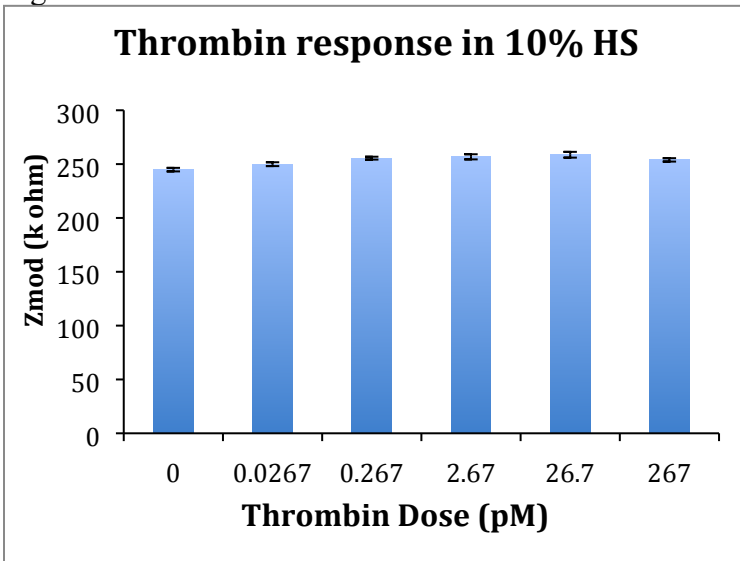


Figure S6.2



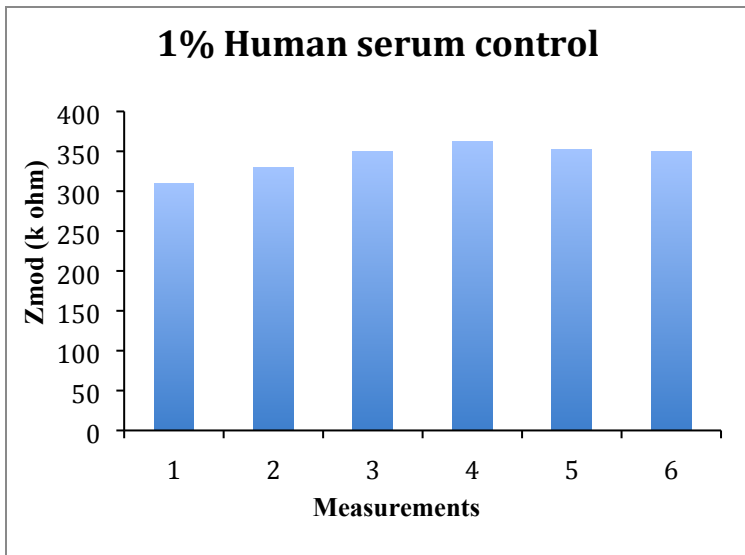


Figure S5.3