Supporting Information

Title: Nanopore Detection of Copper Ions using a Polyhistidine Probe

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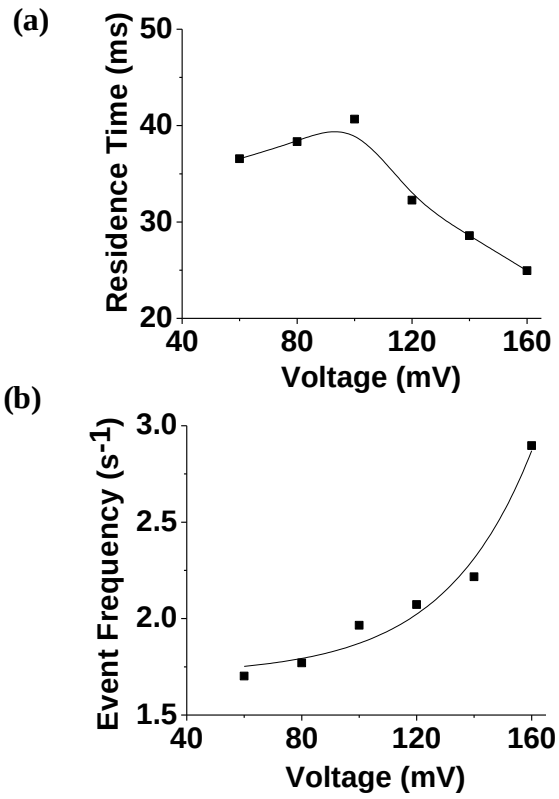

Figure S1. Effect of the applied voltage bias on the (a) mean residence time and (b) frequency of the long-lived events due to Cu^{2+}-peptide complexes. The experiments were performed in a buffer solution comprising 1.0 M NaCl and 10 mM Tris•HCl (pH 7.5) in the presence of 40 μM peptide H10 and 15 μM Cu^{2+} ions.

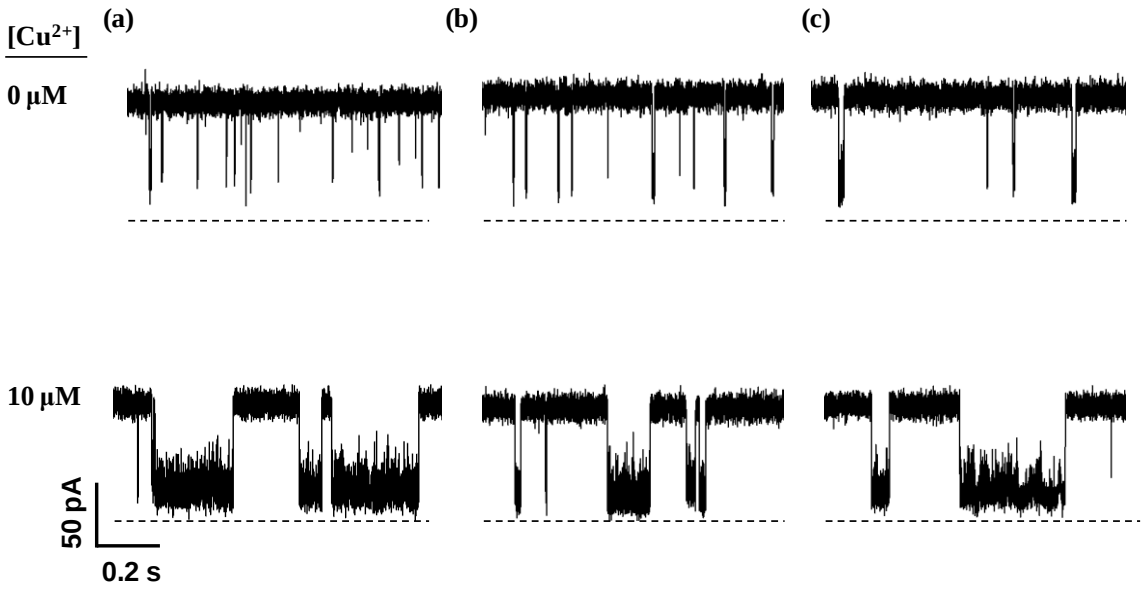

Figure S2. Typical single-channel current recording traces of peptide H10 in the absence and presence of Cu^{2+} ions at (a) pH 6.5, (b) pH 7.5, and (c) pH 8.5, showing the effect of pH on nanopore detection of Cu^{2+}. The experiments were performed with the $(M113F)_7$ α-hemolysin pore in a buffer solution comprising 1.0 M NaCl and 10 mM Tris•HCl at +100 mV (*cis* at ground) in the presence of 40 µM H10.

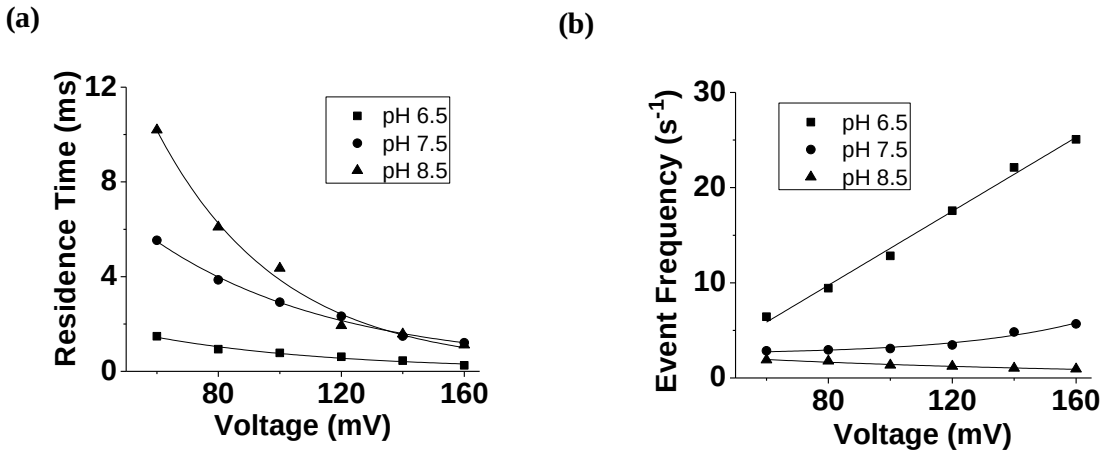

Figure S3. Effects of the applied voltage bias and solution pH on the short-lived events due to free peptides. (a) Residence time plot; and (b) event frequency plot. The experiments were performed in a buffer solution comprising 1.0 M NaCl and 10 mM Tris•HCl in the presence of 40 μM peptide H10.

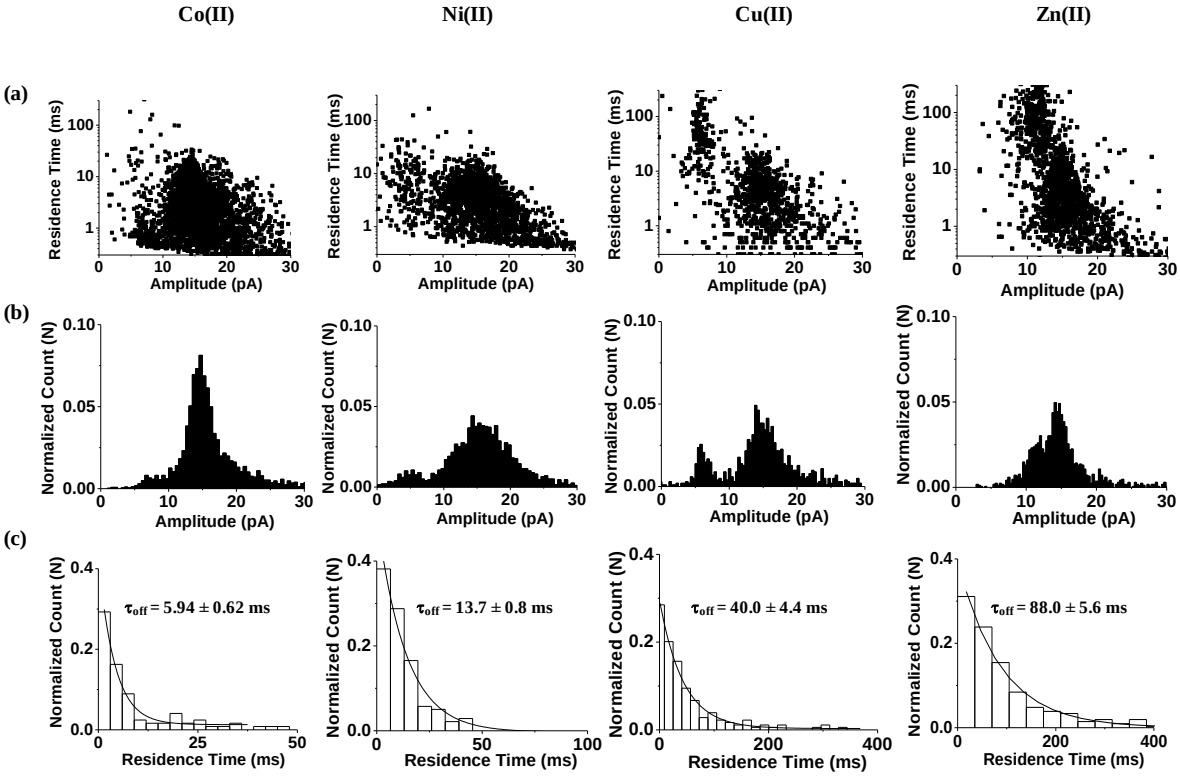

Figure S4. Event signatures of peptide H10 in the presence of various metal ions, demonstrating that Cu^{2+}-peptide complexes could be different from other metal ion-peptide complexes based on event residence times and/or blockage amplitudes. The experiments were performed with the $(M113F)_7$ α-hemolysin pore at +100 mV in the presence of 40 μM H10 and 10 μM metal ions.

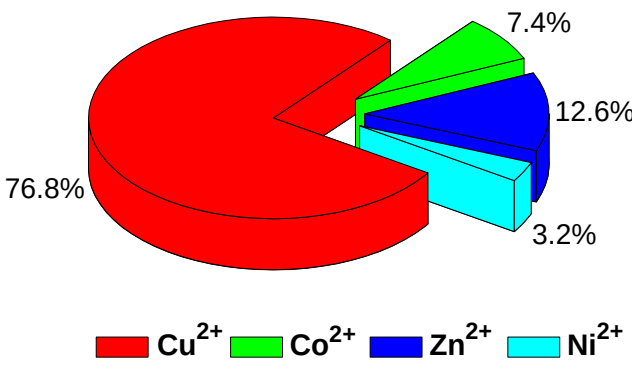

Figure S5. Pie chart showing the contribution from various metal ion-peptide complexes to the current modulation events observed in the nanopore. The experiments were performed with the $(M113F)_7$ α-hemolysin pore at +100 mV in the presence of 40 μM H10 and 10 μM metal ions. Only the events having the residence times larger than 15 ms, and with residual currents within the range from 4 pA to 10 pA were included in the data analysis.

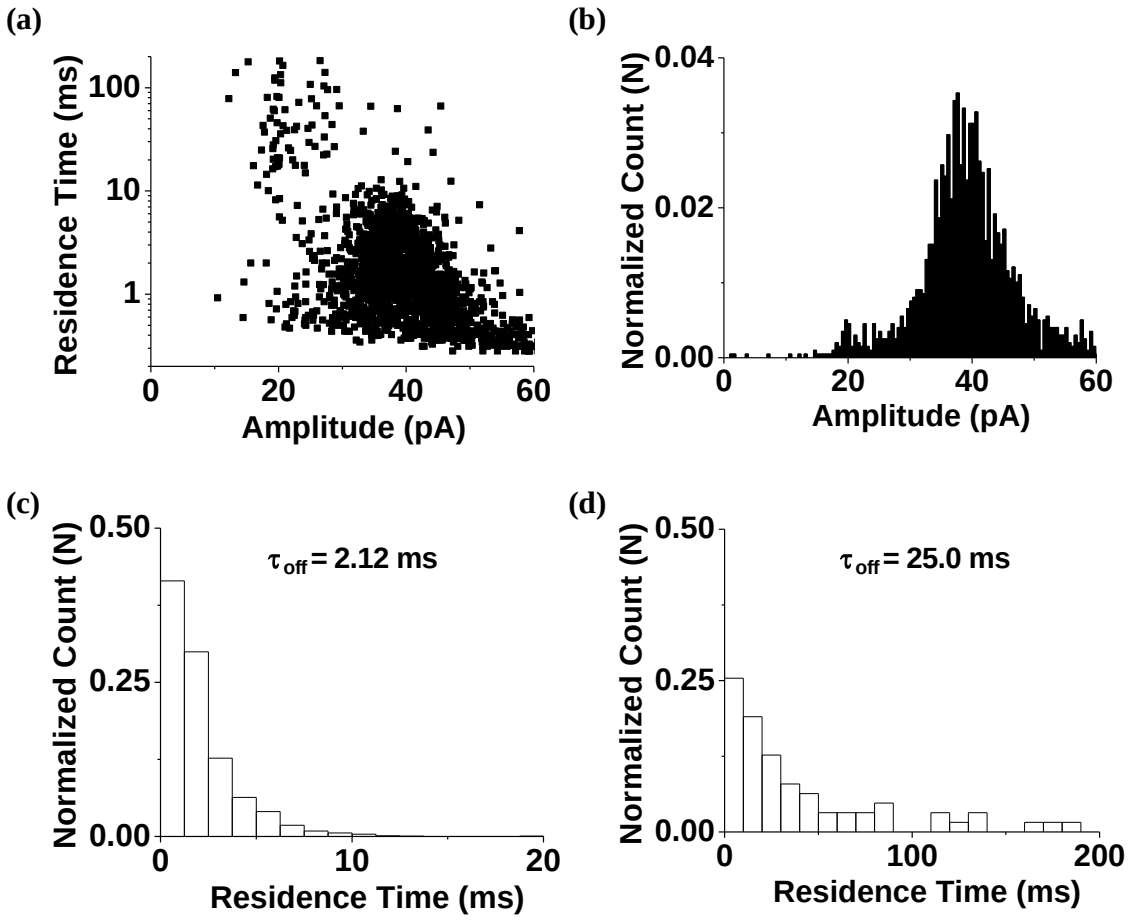

Figure S6. Event signatures of peptide H10 in the presence of Cu^{2+} ions. (a) Scatter plot of event residence time versus amplitude; (b) amplitude histogram; (c) residence time histogram of the short-lived events due to free peptides; and (d) residence time histogram of the long-lived events due to Cu^{2+}-peptide complexes. The experiments were performed with the $(M113F)_7$ α-hemolysin pore in a buffer solution comprising 1.0 M NaCl and 10 mM Tris•HCl (pH 7.5) at +160 mV (*cis* at ground). The concentrations of peptide H10 and Cu^{2+} ions were 40 μM, and 200 nM, respectively.

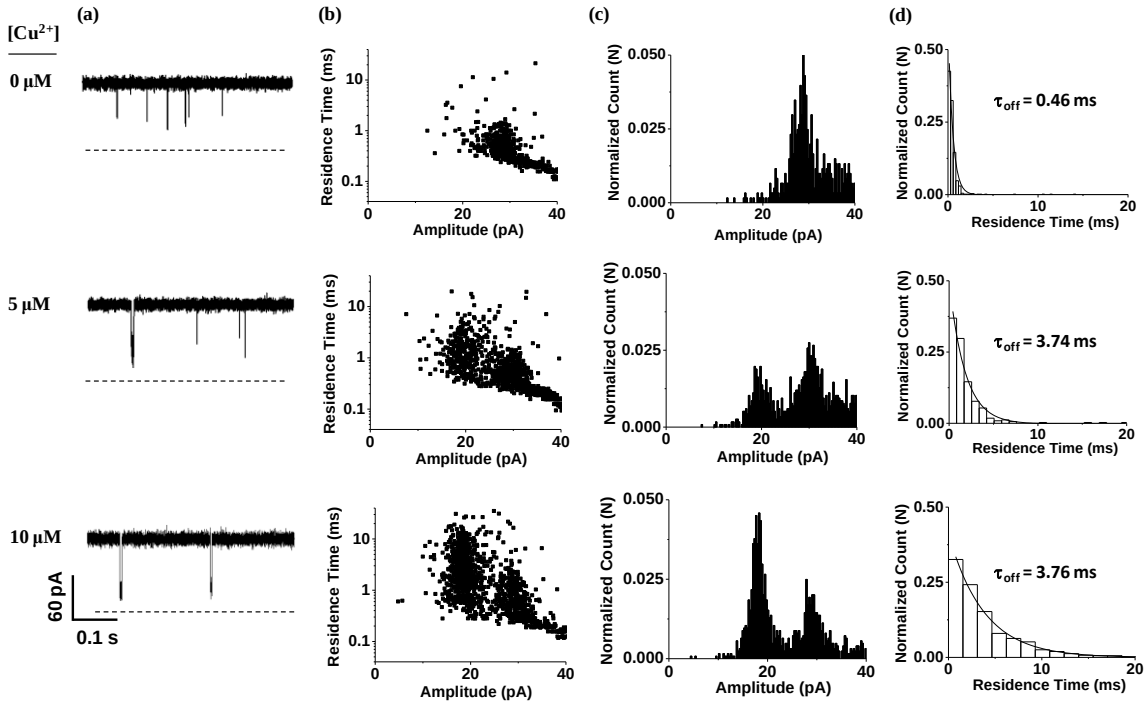

Figure S7. Detection of Cu^{2+} ions using a wide-type α-hemolysin pore. (a) Typical trace segments; (b) scatter plots of event residence time versus amplitude; (c) amplitude histograms; and (d) residence time histograms (note that only the long-lived events were included in the data analysis at 5 μM and 10 μM concentrations of Cu^{2+} ions). The experiments were performed at +100 mV in the presence of 40 μM H10.