Supporting Information

Durable, stable and functional nanopores decorated by self-assembled dipeptides

Abeer Karmi, Gowri Priya Sakala, Dvir Rotem, Meital Reches and Danny Porath**

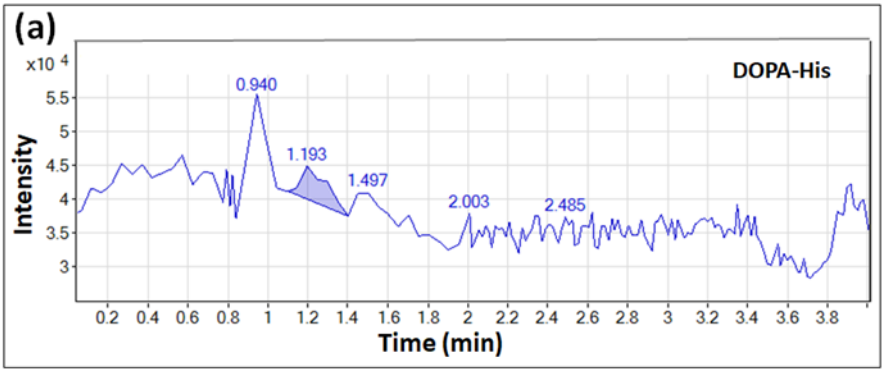
Institute of Chemistry and The Center for Nanoscience and Nanotechnology, The Hebrew University of Jerusalem, Jerusalem 91904, Israel

Corresponding Authors:

danny.porath@mail.huji.ac.il.

meital.reches@mail.huji.ac.il.

Contents:


(a)
DOPA-His
x10 4
Intensity
0.940
1.193
1.497
2.003
2.485
Time (min)

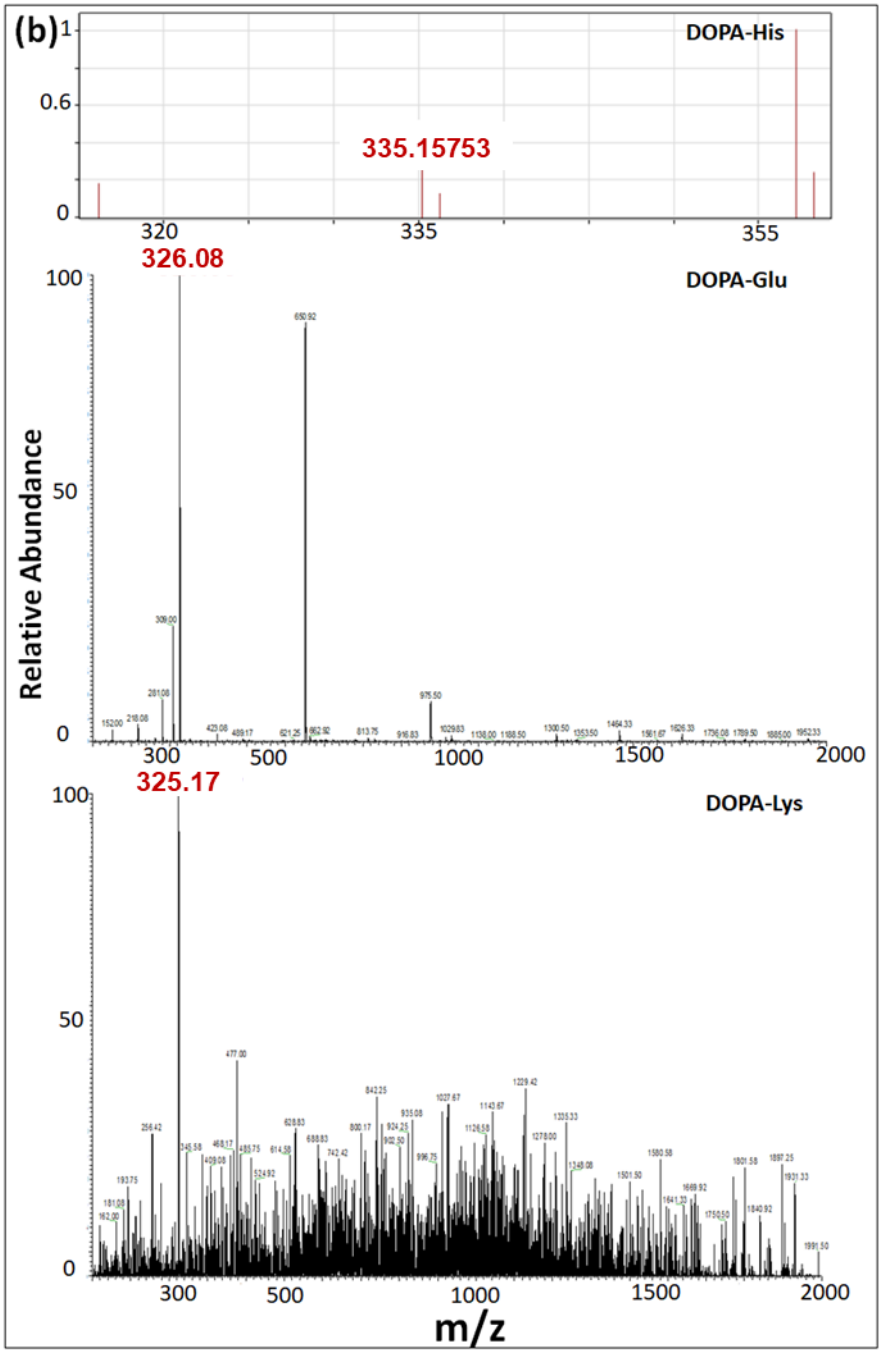

(b)
DOPA-His
335.15753
326.08
DOPA-Glu
325.17
DOPA-Lys
Relative Abundance
m/z

Figure S1: (a) Liquid Chromatography (LC) chromatograms of DOPA-His to confirm the purity of dipeptide. DOPA-His peak was a retention time of 1.2 min. (b) Mass spectra of the three dipeptides used for coating the solid-state nanopores. The calculated mass to charge ratio are 334.157, 327.1431 and 326.1955 for DOPA-His, DOPA-Glu and DOPA-Lys, respectively. The observed masses are 335.157, 326.08 and 325.17 for DOPA-His, DOPA-Glu and DOPA-Lys, respectively.

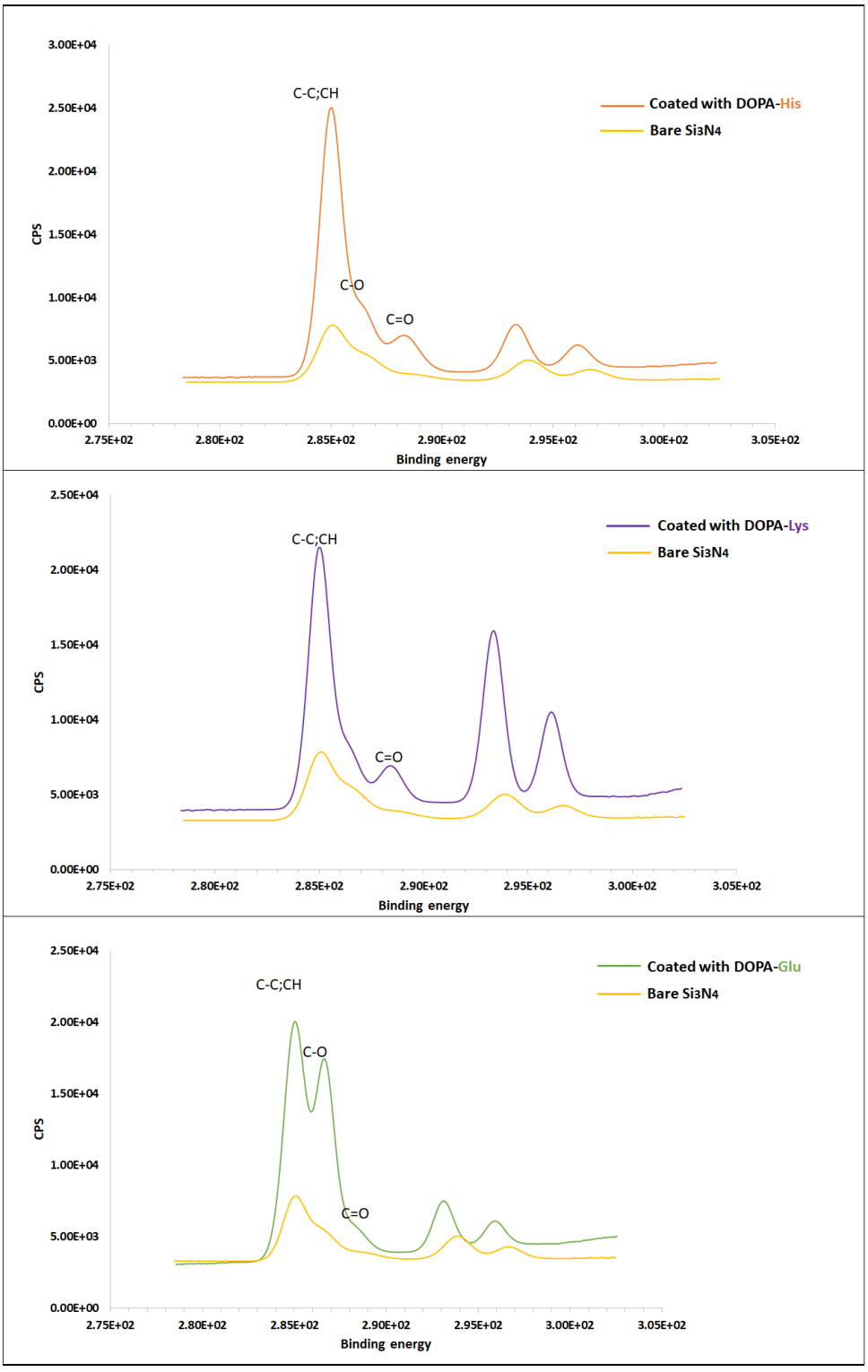

3.00E+04
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
CPS
C-C;CH
C-O
C=O
Coated with DOPA-His
Bare Si3N4
2.75E+02
2.80E+02
2.85E+02
2.90E+02
2.95E+02
3.00E+02
3.05E+02
Binding energy
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
CPS
C-C;CH
C=O
Coated with DOPA-Lys
Bare Si3N4
2.75E+02
2.80E+02
2.85E+02
2.90E+02
2.95E+02
3.00E+02
3.05E+02
Binding energy
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
CPS
C-C;CH
C-O
C=O
Coated with DOPA-Glu
Bare Si3N4
2.75E+02
2.80E+02
2.85E+02
2.90E+02
2.95E+02
3.00E+02
3.05E+02
Binding energy

Figure S2: X-ray photoelectron spectroscopy (XPS) analysis of Si_3N_4 surface without coating (yellow line in all the images), and after coating with each of the three dipeptides (DOPA-His, DOPA-Lys and DOPA-Glu). The carbon binding energies are presented. We can see that the intensity of carbon peaks got increased after coating in all the samples. These results suggest the presence of the dipeptide layer on the surface. The binding energies of nitrogen are not clear, since it abundant both in the Si_3N_4 surface and in the peptides.

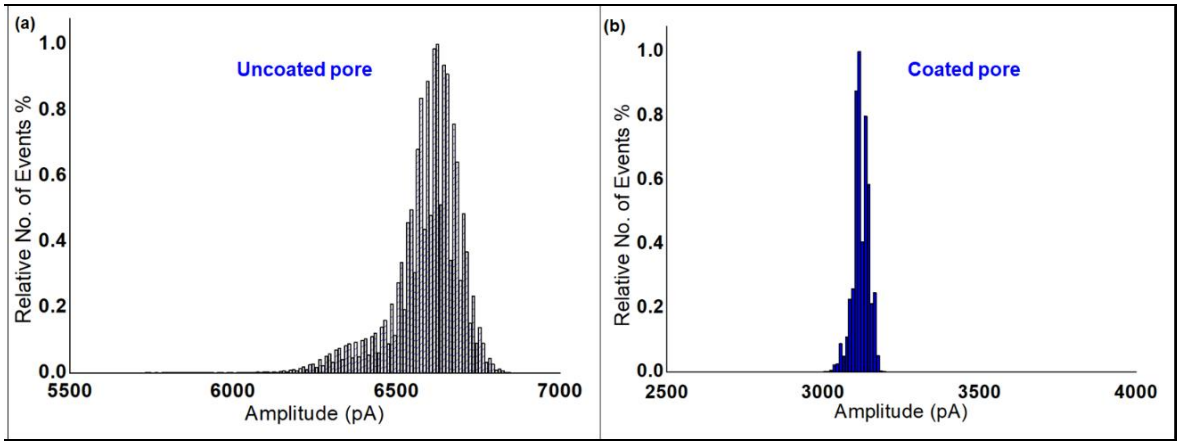


Figure S3: Current histogram for a 10 minutes traces of DOPA-His peptide uncoated (a) and coated (b) pores. The width of the histograms shows that the background noise level of the current through the coated pore is smaller than through the uncoated pore. The measurements were done in 1 M KCl, 10 mM Tris-HCl, 1 mM EDTA, and pH 7.5, 200 mV, pore size 10 nm.

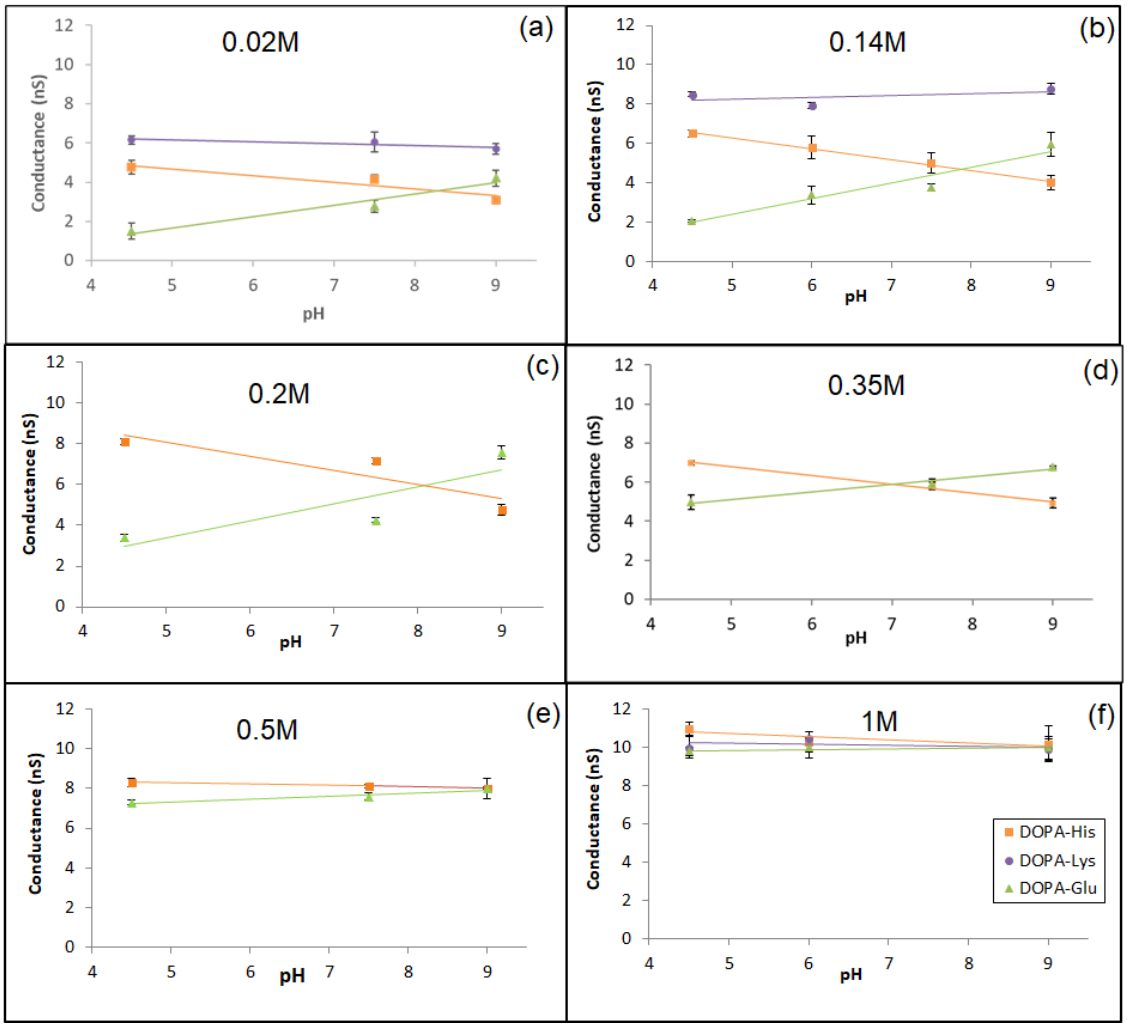


Figure S4: Conductance measurements through dipeptides treated nanopores as a function of pH change. Measurements were performed in 0.020 M (a), 0.14 M (b) 0.20 M (c) 0.35 M (d) 0.50 M (e) 1 M (f) KCl, 10 mM tris-HCl/ succinic acid, 1 mM EDTA (pH 4.5, 6, 7.5 and 9) at 100 mV.

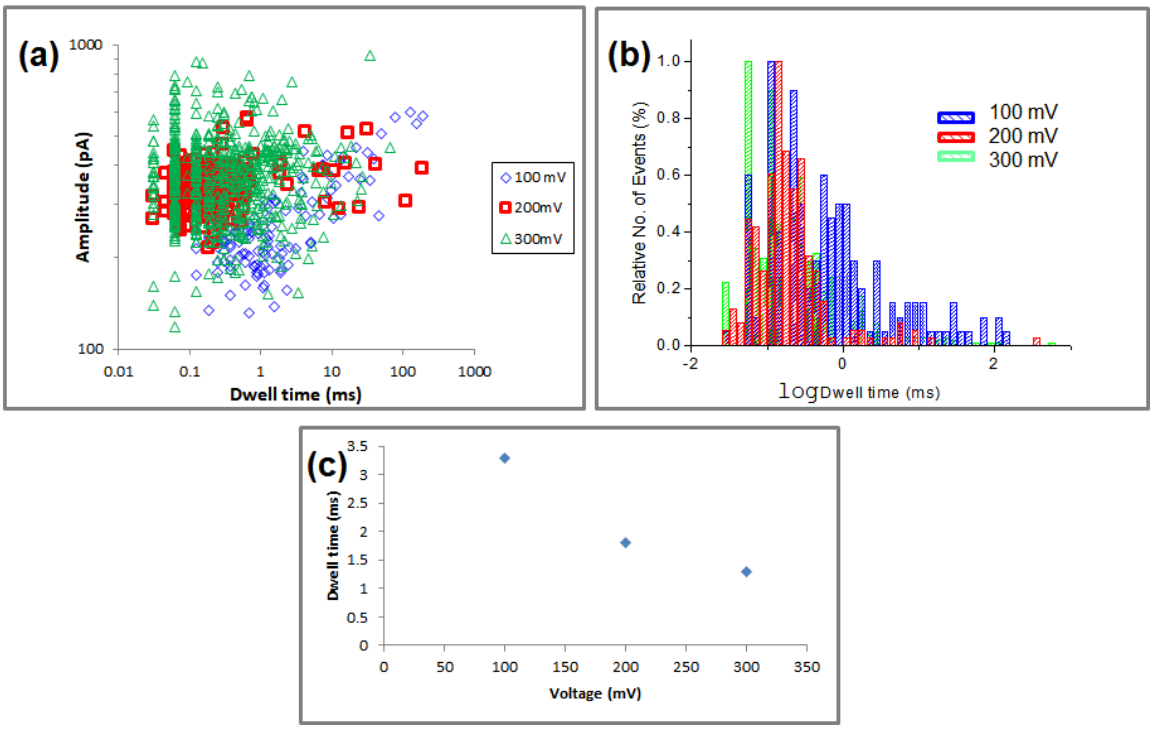


Figure S5: Recording of 2 Kbp DNA translocation using 10 nm nanopores coated with DOPA-His at 1 M KCl, 10 mM tris-HCl, 1 mM EDTA, 10 % glycerol at pH 7.5, at 100, 200 and 300 mV. (a) Scatter plot of events dwell times (ms) and amplitudes (pA). (b) Histogram, showing events dwell time distribution at pH 7.5, at 100, 200 and 300 mV. (c) The means of dwell time in (b) as a function of voltage.

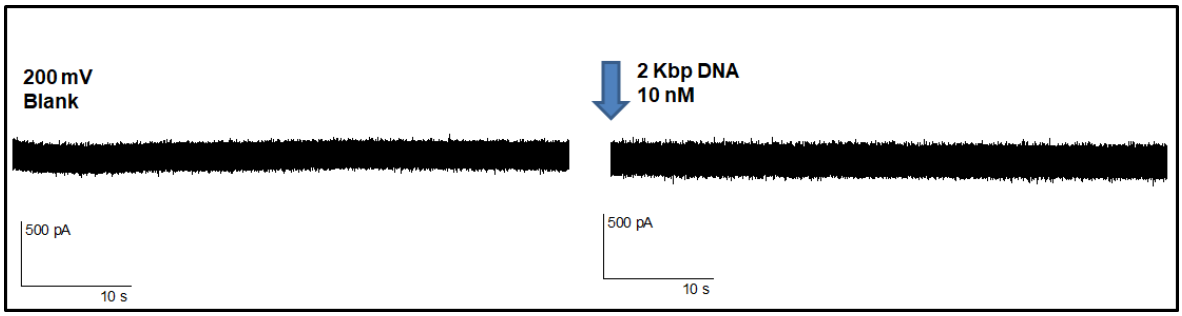


Figure S6: Current trace through DOPA-Glu modified nanopore, before (left) and after (right) adding 10 nM 2 Kbp DNA. Measurements were performed by applying voltage of 200 mV, using 1 M KCl, and 10 mM tris-HCl, 1 mM EDTA, at pH 7.5.

Figure S7: Current trace through DOPA- Lys modified nanopore, shows fluctuations through the pore without adding DNA. Measurements were performed by applying voltage of 200 mV, using 1 M KCl, and 10 mMtris-HCl, 1 mM EDTA, at pH 7.5.