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Supporting information

Sensitive immunosensing of *α*-Synuclein protein in human plasma samples using gold nanoparticle conjugated with graphene: An innovative immuno-platform towards early stage identification of Parkinson disease using point of care (POC) analysis

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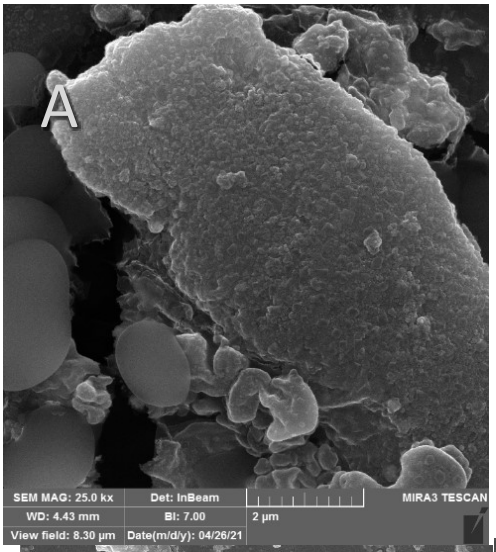
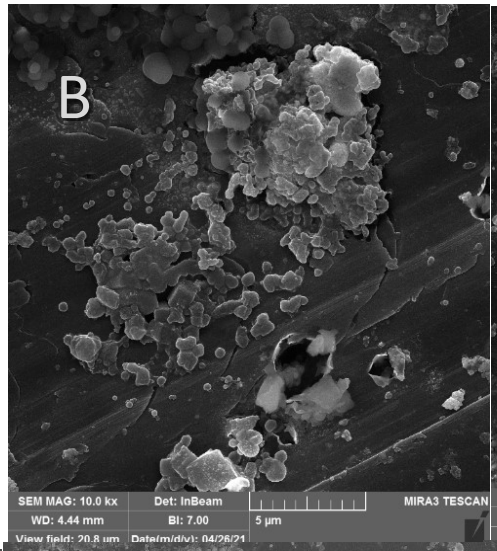

A
SEM MAG: 25.0 kx
Det: InBeam
MIRA3 TESCAN
WD: 4.43 mm
BI: 7.00
2 µm
View field: 8.30 µm
Date(m/d/y): 04/26/21


B
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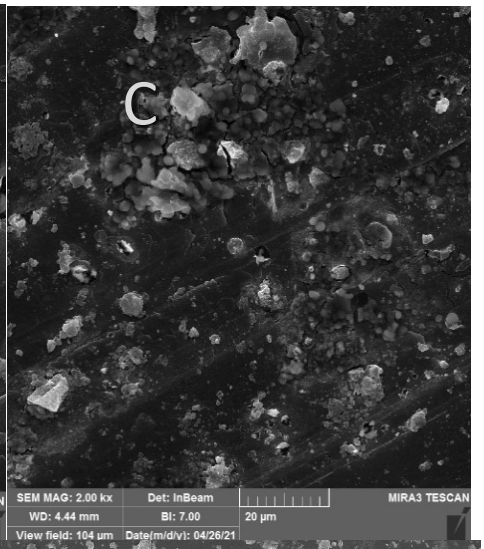
Det: InBeam
MIRA3 TESCAN
WD: 4.44 mm
BI: 7.00
5 µm


C
SEM MAG: 2.00 kx
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WD: 4.44 mm
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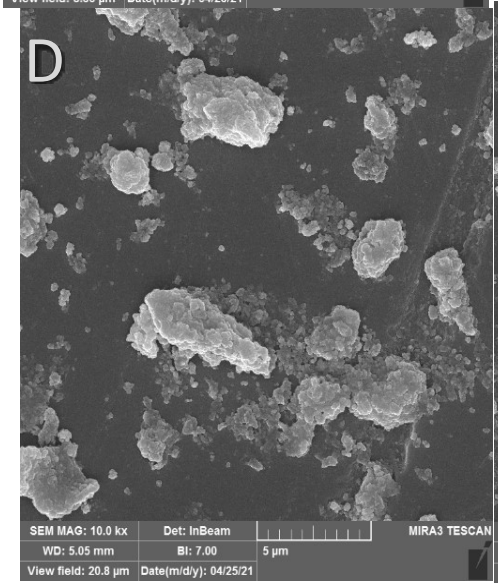
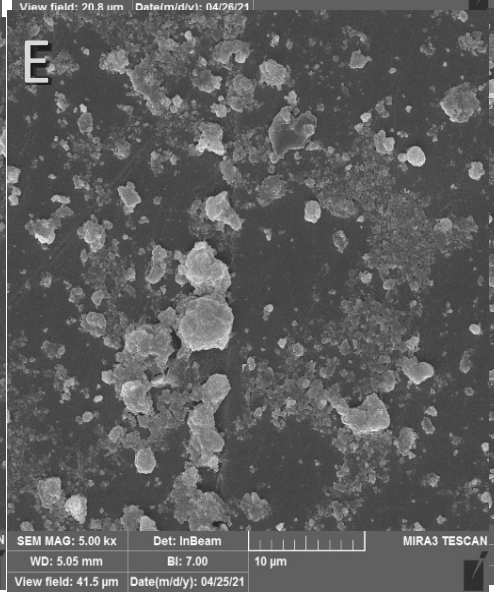
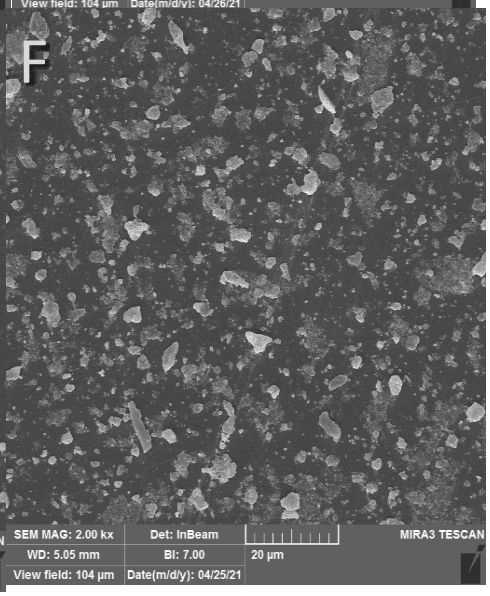
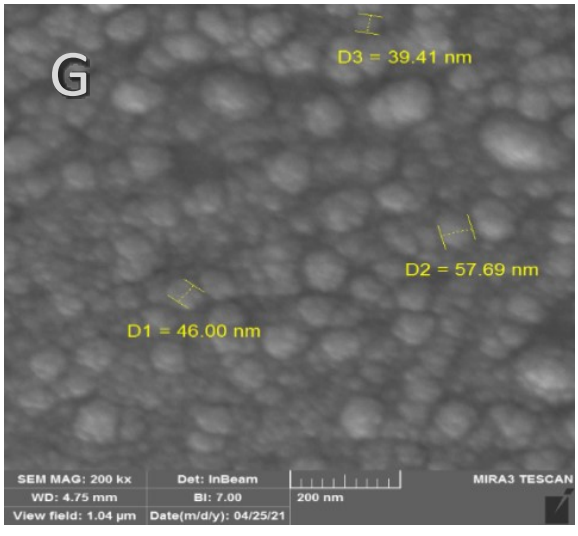
20 µm
View field: 104 µm
Date(m/d/y): 04/26/21


D
SEM MAG: 10.0 kx
Det: InBeam
MIRA3 TESCAN
WD: 5.05 mm
BI: 7.00
5 µm
View field: 20.8 µm
Date(m/d/y): 04/25/21


E
SEM MAG: 5.00 kx
Det: InBeam
MIRA3 TESCAN
WD: 5.05 mm
BI: 7.00
10 µm
View field: 41.5 µm
Date(m/d/y): 04/25/21


F
SEM MAG: 2.00 kx
Det: InBeam
MIRA3 TESCAN
WD: 5.05 mm
BI: 7.00
20 µm
View field: 104 µm
Date(m/d/y): 04/25/21


G
D3 = 39.41 nm
D2 = 57.69 nm
D1 = 46.00 nm
SEM MAG: 200 kx
Det: InBeam
MIRA3 TESCAN
WD: 4.75 mm
BI: 7.00
200 nm
View field: 1.04 µm
Date(m/d/y): 04/25/21

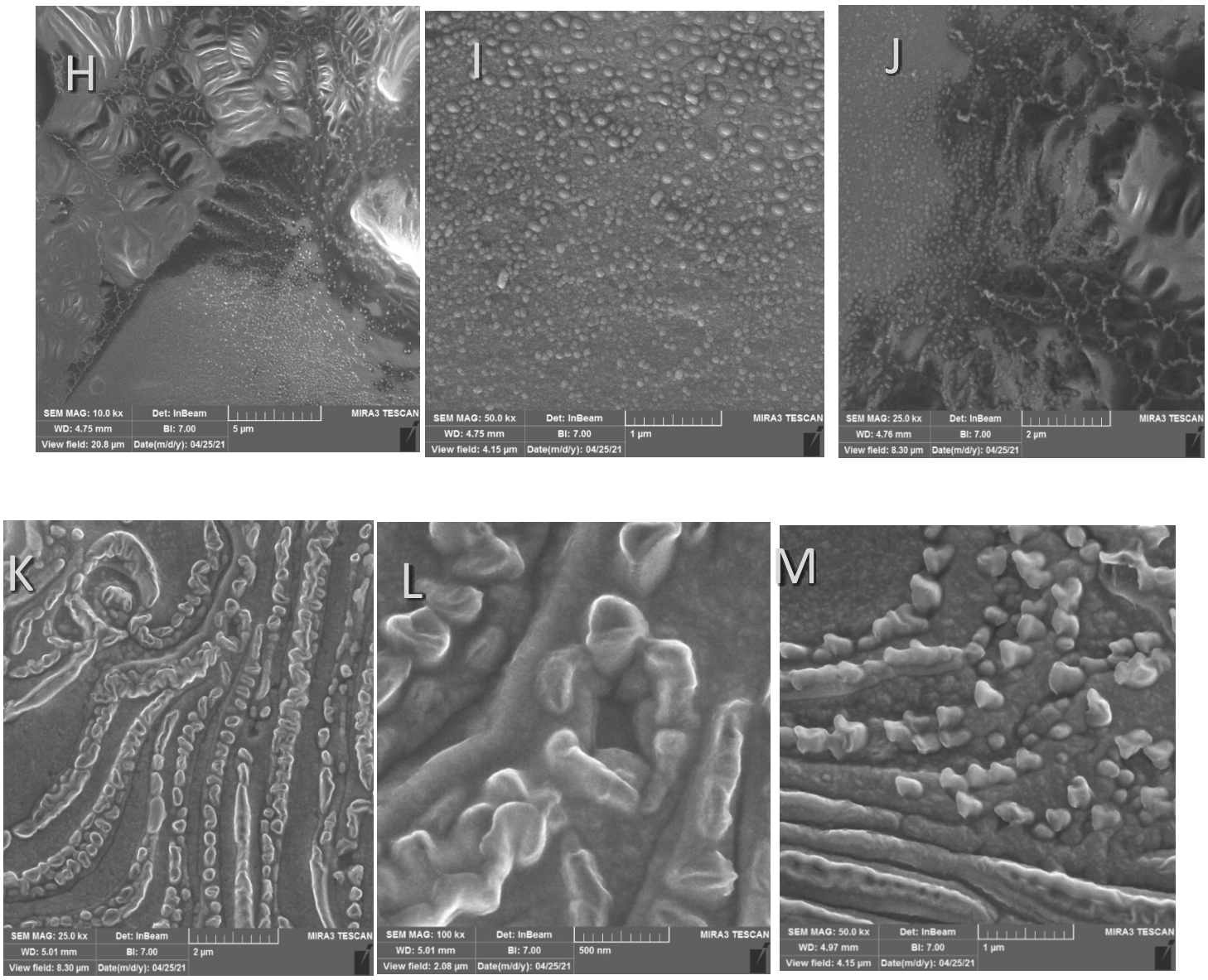
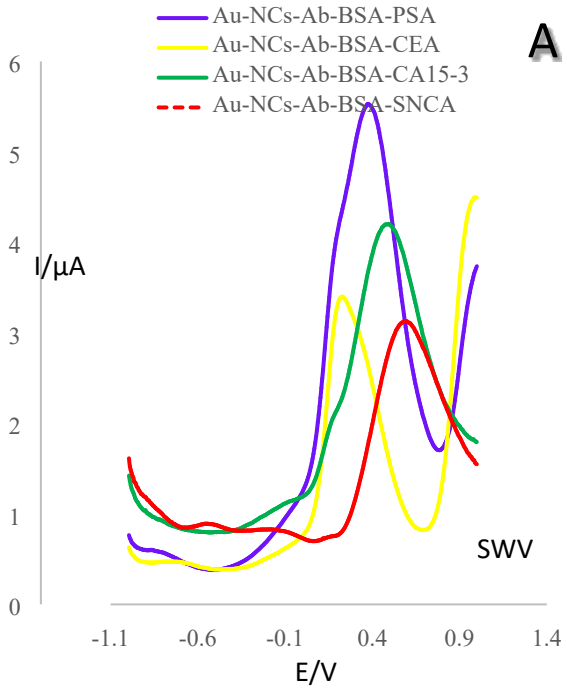
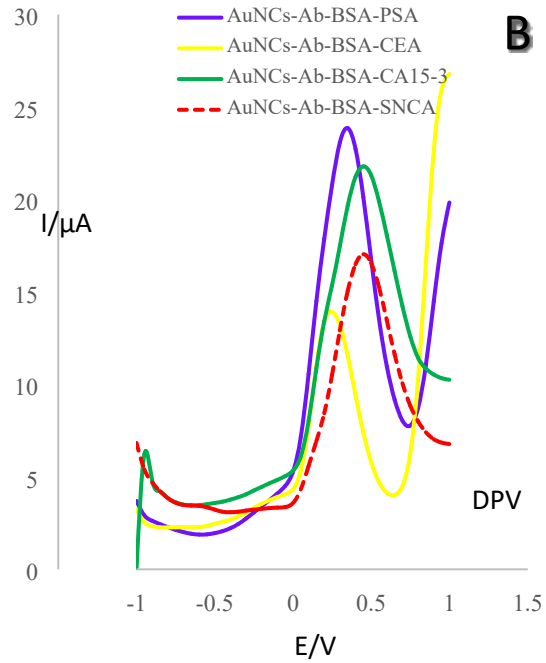
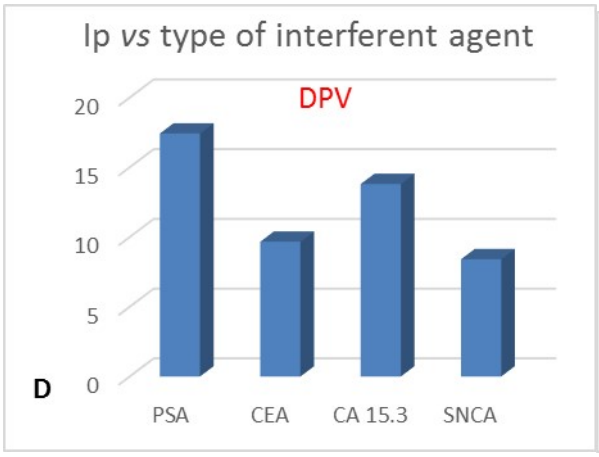
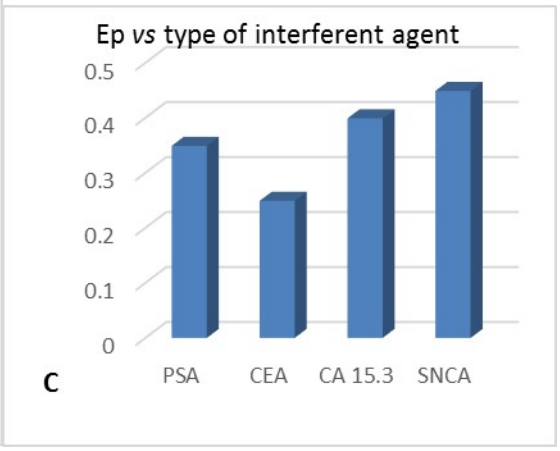


Figure S1. FE-SEM images of **A-C)** AuNCs, **D-F)** GC electrode/AuNCs, **G-J)** GC electrode/AuNCs/Ab and **K-M)** GC electrode/AuNCs/Ab/BSA/Antigen in different magnification.


Au-NCs-Ab-BSA-PSA
Au-NCs-Ab-BSA-CEA
Au-NCs-Ab-BSA-CA15-3
Au-NCs-Ab-BSA-SNCA
A
I/µA
SWV
E/V
6
5
4
3
2
1
0
-1.1
-0.6
-0.1
0.4
0.9
1.4


AuNCs-Ab-BSA-PSA
AuNCs-Ab-BSA-CEA
AuNCs-Ab-BSA-CA15-3
AuNCs-Ab-BSA-SNCA
B
I/µA
DPV
E/V
30
25
20
15
10
5
0
-1
-0.5
0
0.5
1
1.5


Ip vs type of interferent agent
DPV
D
20
15
10
5
0
PSA
CEA
CA 15.3
SNCA


Ep vs type of interferent agent
C
0.5
0.4
0.3
0.2
0.1
0
PSA
CEA
CA 15.3
SNCA

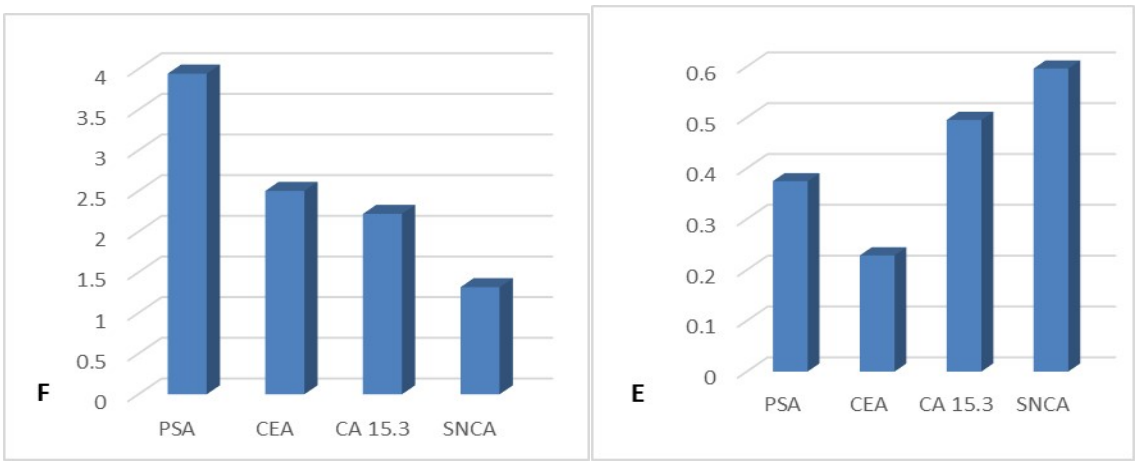
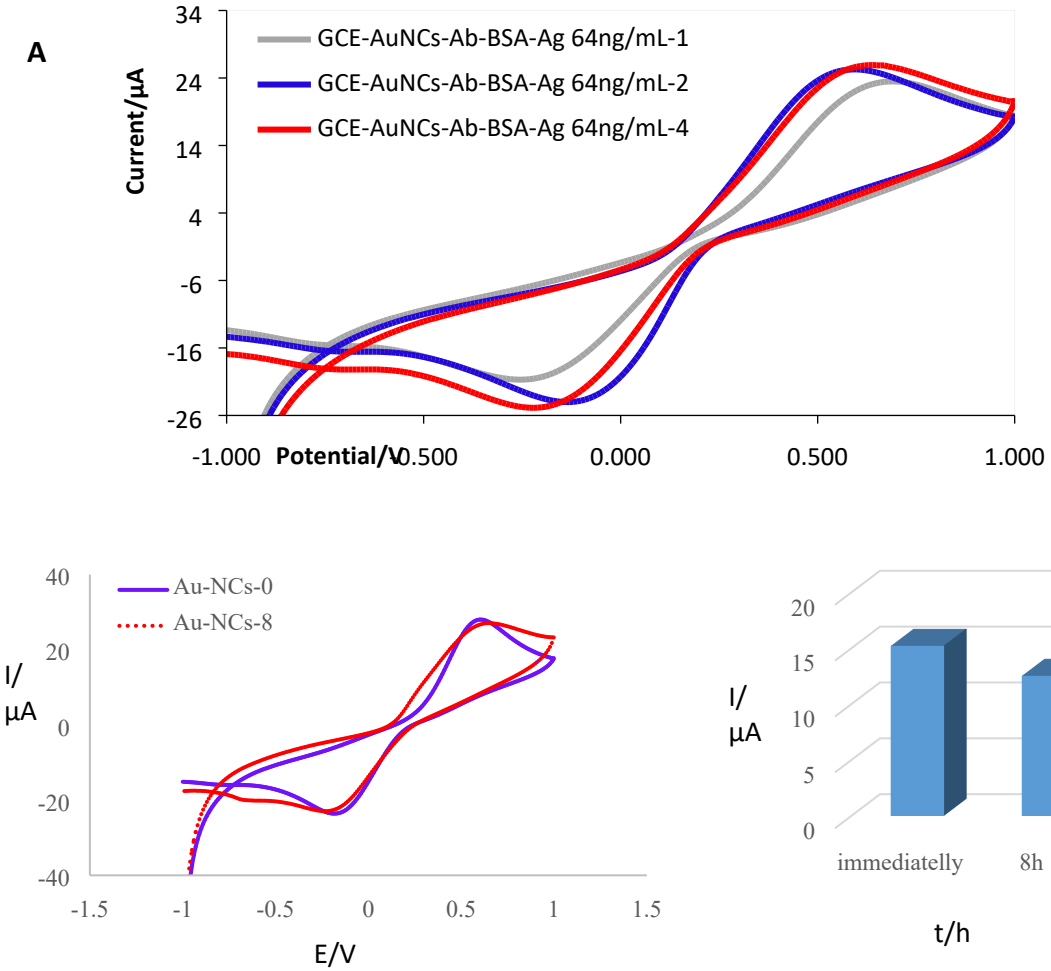


Figure S2. A) SWVs and **B)** DPVs of the designed immunosensor for hybridization by SNCA, CA 15.3, CEA and PSA in 0.01M $[Fe(CN)_6]^{3-/4-}$/KCl solution **C-F)** and related histograms. (n=3, Sd=2.53).



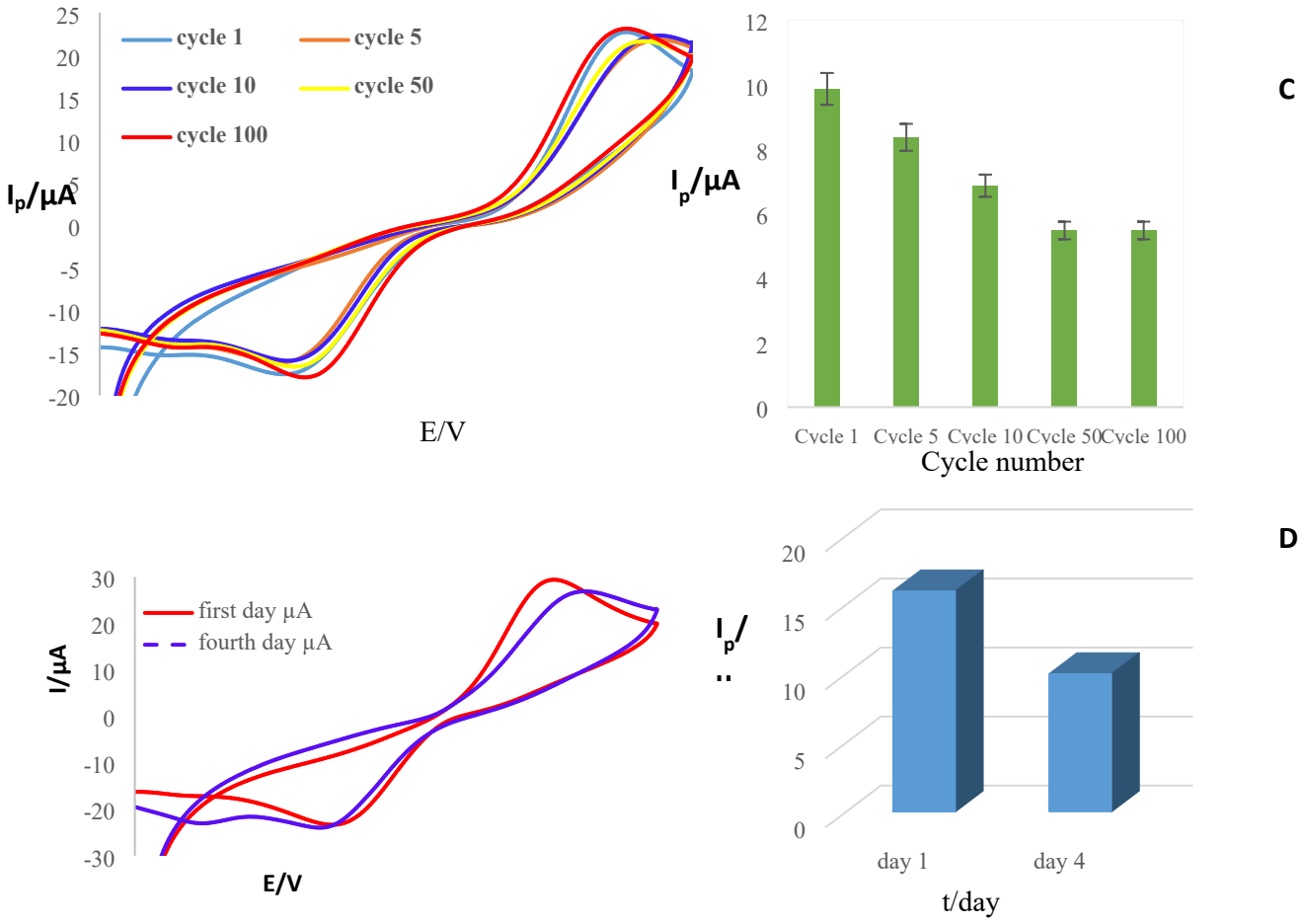


Figure S3. A) Reproducibility of immunosensor in 0.01M $[Fe(CN)_6]^{3-/4-}$/KCl solution (as supporting electrolyte) in a potential range of -1 to +1 V and scan rate of 100 mV/s. **B)** Inter-day stability of AuNCs on the surface of GC electrode. **C)** CVs of immunosensor in different cycle number and related histogram **D)** Intraday stability of Ab/AuNCs/GC electrode. (n=3, Sd=2.85).

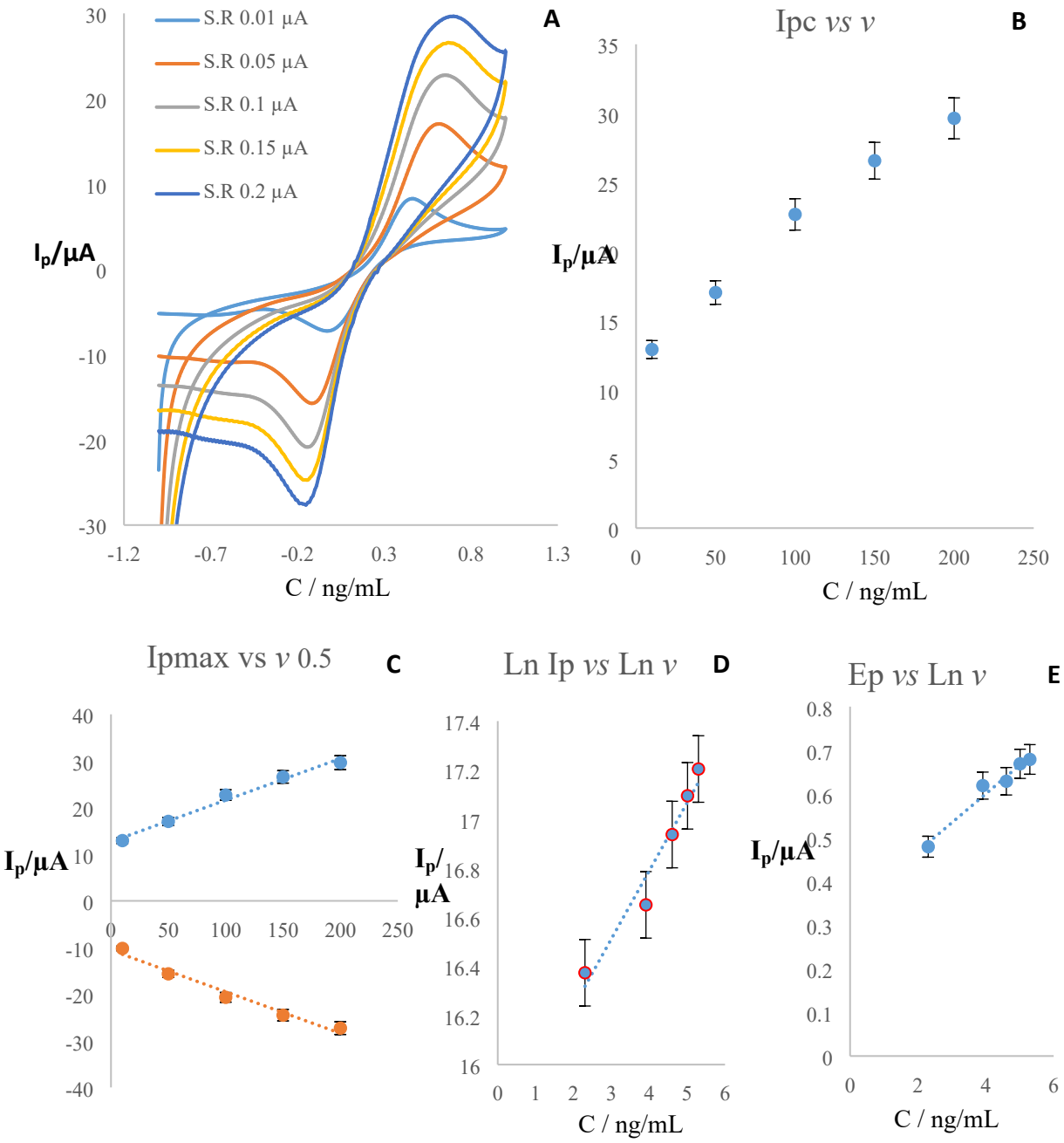


Figure S4. A) CVs of AuNCs/GC electrode in different scan rates (10, 50, 100, 150 and 200 mV/s). **B)** Variations of oxidation peak current versus different sweep rate. **C)** Calibration curve of oxidation peak current versus square root of different sweep rate. **D)** Calibration curve of Neperian logarithm of oxidation peak current versus Neperian logarithm of scan rate. **E)** Calibration curve of reduction peak position versus sweep rate in term of Neperian logarithm.