Electrochemical immunosensor based on AuBP@Pt nanostructure and AuPd-PDA nanozyme for ultrasensitive detection of APOE4

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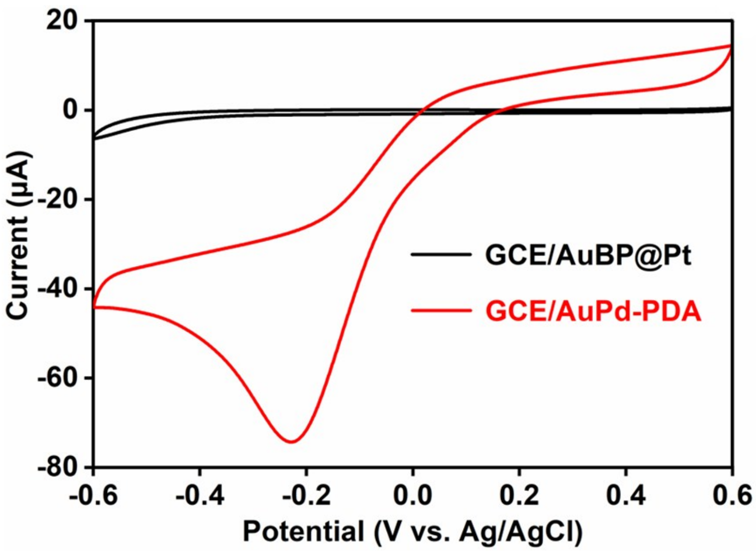

Figure S1. CV curves of GCE/AuBP@Pt and GCE/AuPd-PDA electrodes in Ar-saturated PBS (0.1 M, pH 7.4) buffer containing 2 mM H_2O_2.

The FTIR characterization of AuPd-PDA-Ab$_2$.

The characteristic peaks of AuPd-PDA are at 1508 cm^{-1} (scissoring vibration of N-H), 1353 cm^{-1} (bending vibration of O-H), and 1284 cm^{-1} (stretching vibration of phenolic C-O).

After the Ab_2 conjugation, the amide I (1648 cm^{-1}, C=O stretching) and amide II (1537 cm^{-1}, overlap of N-H bending and C-N stretching) bands of the Ab_2 are observed, which indicates that the human APOE4 detection antibody is successfully attached on the AuPd-PDA.

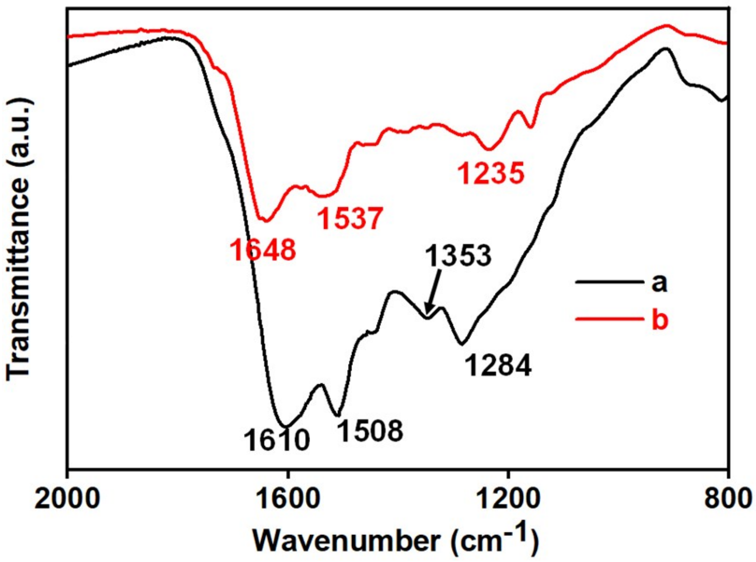

Figure S2. The FT-IR spectrum of AuPd-PDA (a) and AuPd-PDA-Ab_2 (b).

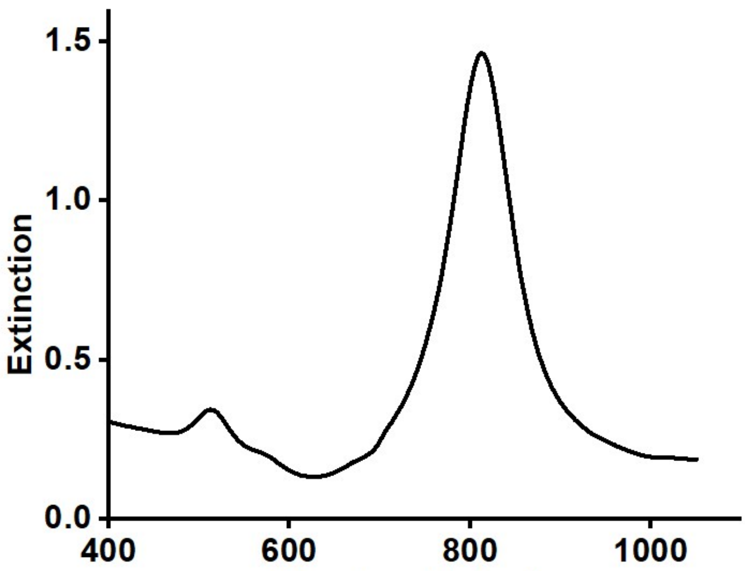

Figure S3. The characterization of Au BPs by extinction spectrum.

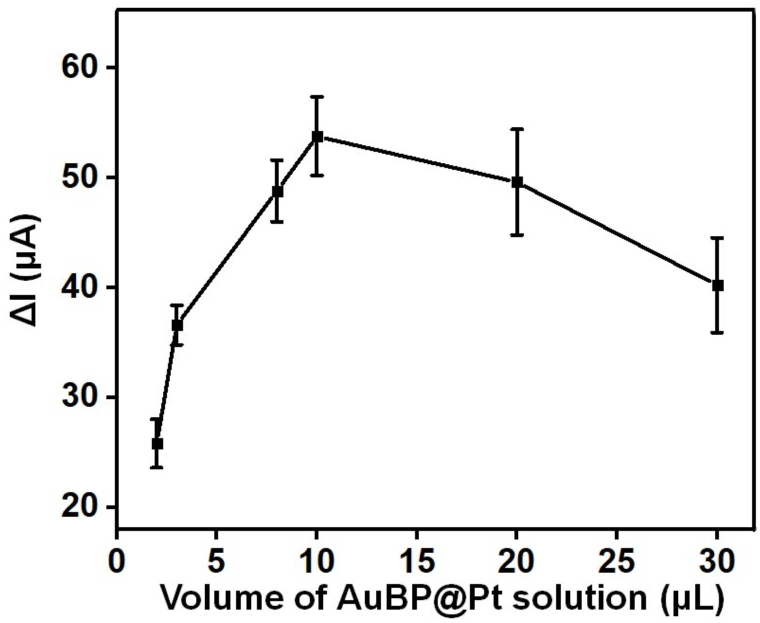

Figure S4. Optimization of AuBP@Pt volume when the concentration is constant. error bar = RSD (n = 5).

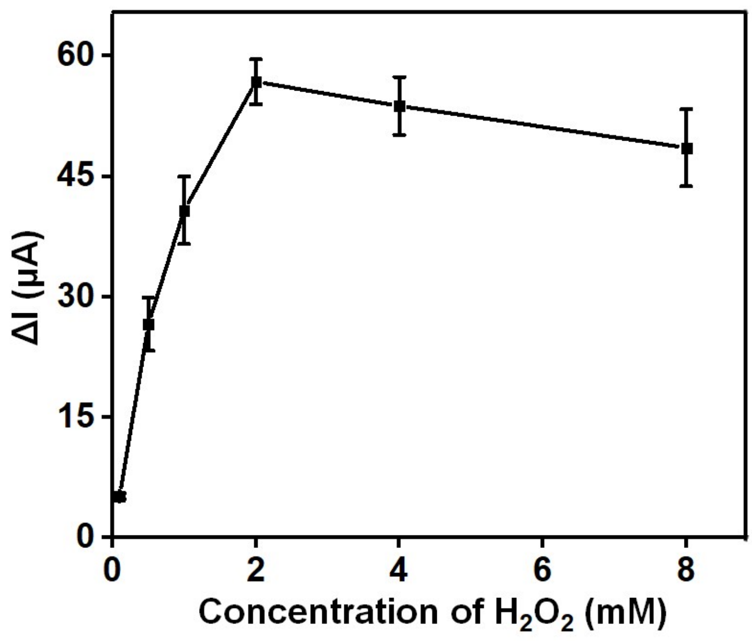

Figure S5. Optimization of H_2O_2 concentration. Error bar = RSD (n = 5).

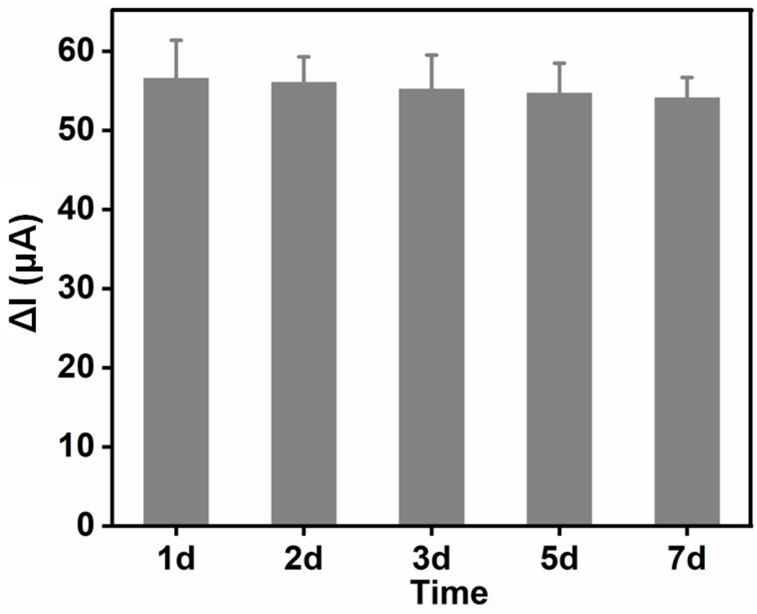

Figure S6. The stability study of the electrochemical immunosensor based on AuBP@Pt nanostructures and AuPd-PDA nanozyme. Error bar = RSD (n = 5)

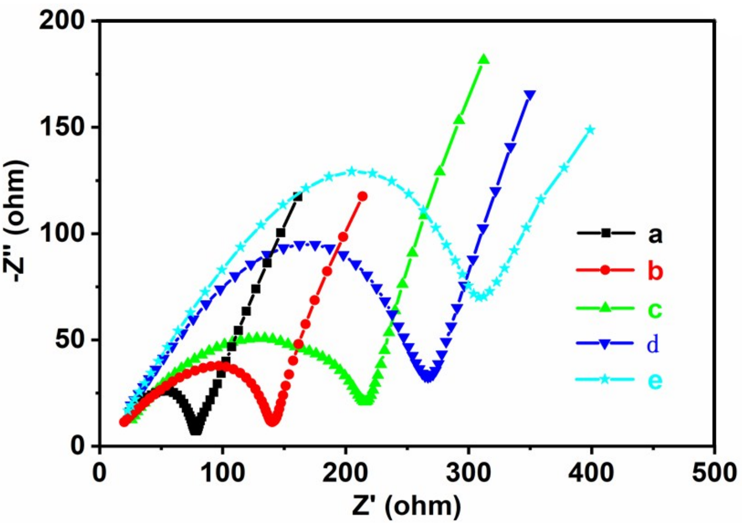

Figure S7. The characterization of surface-modification on GCE/Au/AuBP@Pt electrode: EIS of the GCE/Au/AuBP@Pt electrode (a) modified with Ab_1 (b), Ab_1 + BSA (c), Ab_1 + BSA + APOE4 (d) Ab_1 + BSA + APOE4 + Ab_2 label (e). The EIS was carried out in 5 mM $[Fe(CN)6]^{3-}/[Fe(CN)6]^{4-}$ at scan rates of 50 mV·s^{-1}.

Table S1. Comparison between different methods for APOE or APOE4 detection.

Methods	Linear range (ng/mL)	LOD (ng/mL)	Target	Reference
Magneto-immunoassay	10～200	12.5	APOE	1
Nanobiosensor based on porous magnetic microspheres (PMM)	0.1～12.5	0.08	APOE	2
Electrochemical sandwich sensor	1～10000	0.3	APOE4	3
colorimetric immunosensor based on nanobody	0.001-10	0.00042	APOE	4
Electrochemical immunosensor	0.05-2000	0.015	APOE4	This work

Table S2. Determination of human APOE4 protein in goat serum.

Added APOE4 concentration (ng/mL)	Average ΔI (μA, n=5)	Measured concentration (ng/mL)	RSD (%, n=5)	Recovery (%, n=5)
1	36.83	0. 97	3.47	97.00
10	55.62	10.48	5.46	104.80
100	73.66	102.78	5.31	102.78

References

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