Electronic supplementary information (ESI) for

An Ultrasensitive, Non-enzymatic Glucose Assay via Gold Nanorods-Assisted Generation of Silver Nanoparticles

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Experimental section

D-(+)-glucose was purchased from Sigma-Aldrich. All the other chemicals used in the experiment were analytical grade, and distilled water was used throughout the work. Glucose kit (Hexokinase) was bought from DiaSys Diagnostic Systems (Shanghai) co., LTD. Accu-Chek® Active was a personal glucose meter produced by Roche LTD.

The UV/Vis spectra were measured with a UV2450 spectrophotometer (Shimadzu). The optical density was recorded by a microplate spectrophotometer (TECAN, Infinite®200 PRO). Zeta potential was performed on a Zeta Sizer Nano ZS (Malvern Zetasizer 3000HS). TEM images were obtained with a Tecnai G^2 20 S-TWIN transmission electron microscope operated at an acceleration voltage of 200 kV.

In all the experiment, 4 μL Au NRs/Au NPs (1 nM), 4 μL glucose and 3 μL $Ag(NH_3)_2OH$ were sequentially added into distilled water to reach a final volume of 200 μL. The reaction was carried out in 80 ^oC for 8 minutes and then the optical density of the solution was measured at 410 nm. To get the calibration curve, a series of glucose concentrations from 0 to 20 μM were involved. Then the UV/Vis spectra of the solution were obtained with UV/Vis spectrophotometer and the absorbance at 410 nm were recorded with microplate spectrophotometer. We investigated the effects of both the positively charged Au NRs/Au NPs and negatively charged Au NRs/Au NPs on GAPS. Cetyltrimethyl ammonium bromide capped Au NRs (CTAB-Au NRs) and quaternary ammonium capped Au NPs (QA-Au NPs) are positively charged, while polystyrene sulfonate capped Au NRs (PSS-Au NRs) and citrate capped Au NPs(C-Au NPs) are negatively charged.

To show the good specificity towards glucose assay, we tested chemicals and biological samples that might potentially interfere with the reaction including sodium ascorbate, citrate, sodium citrate, bovine serum albumin (BSA), fetal bovine serum

(FBS), urea, cysteine and histidine. The original concentrations of all the interferents were 200 μM except BSA and FBS (they are both 2 mg/mL). 4 μL of all these samples were separately added into the solution which contained 4 μL PSS-Au NRs (1 nM), 3 μL $Ag(NH_3)_2OH$ and 189 μL distilled water. The reaction was carried out in 80 ^oC for 8 minutes and then the optical density of the solution was measured at 410 nm.

As to the competitive experiment, Cu^{2+} and Mg^{2+} at different concentrations were involved in the solution as the competitors of Ag^+. Typically, we added 4 μL PSS-Au NRs (1 nM), 4 μL glucose (10 μM) and 3 μL $Ag(NH_3)_2OH$ into the solution, then different amounts of Cu^{2+} (or Mg^{2+}) and distilled water were added to reach a final volume of 200 μL. The reaction was carried out in 80 ^oC for 8 minutes and then the optical density of the solution was measured at 410 nm.

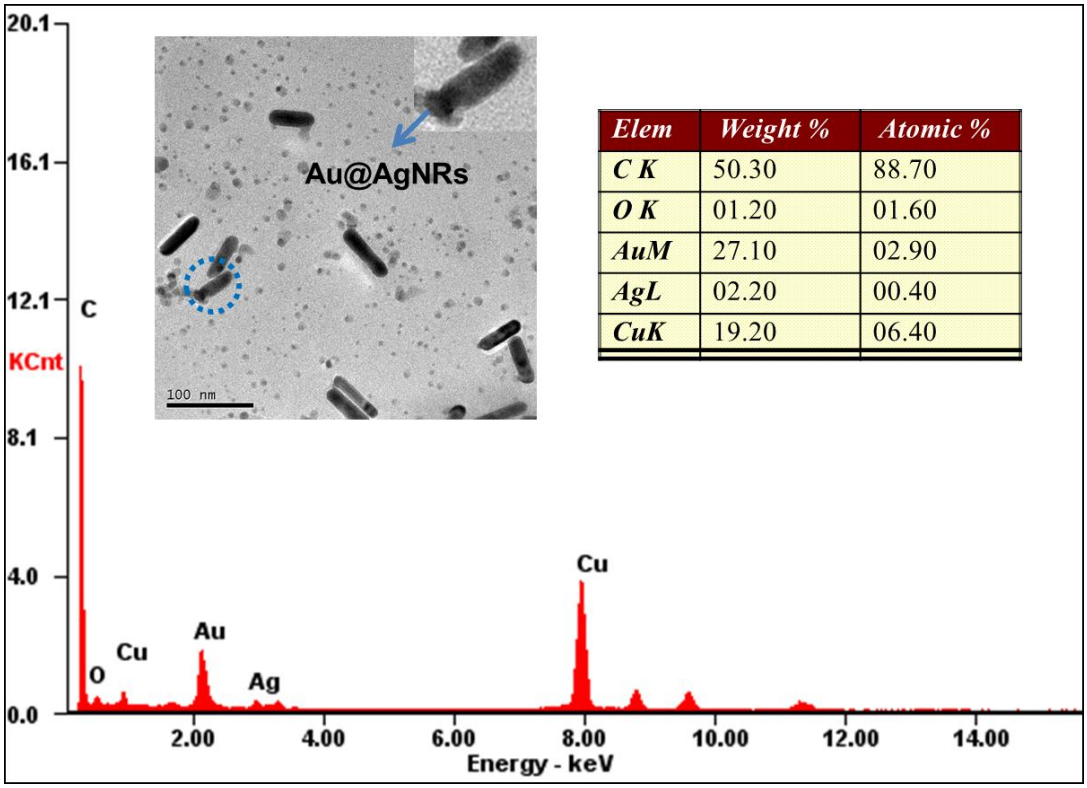
We used human plasma for the real sample assays. The human blood was obtained from healthy volunteers and centrifuged at 3000 r/min for 5 minutes to remove the red blood cells. The obtained plasma was then filtered at 10000 g for 15 minutes to get rid of the proteins. After this, we applied three different methods to assay the glucose concentration in the pretreated plasma samples. For GAPS, we sequentially added 4 μL PSS-Au NRs (1 nM), 4 μL diluted plasma samples and 3 μL $Ag(NH_3)_2OH$ into 189 μL distilled water. The reaction was carried out in 80 ^oC for 8 minutes and then the optical density of the solution was measured at 410 nm.

Table S1 A comparison of GAPS and other previously reported methods.

Materials	Type	Linear range	LOD	Reference
Fe_3O_4 NPs	Enzymatic	6 μM–2.2 mM	6 μM	1
Ag NPs & CNTs	Enzymatic	0.5–50 μM	0.1 μM	2
Carbon	Enzymatic	0.02−6.2 mM	8 μM	3
Au NPs & Graphene	Enzymatic	0.01–46 mM	5 μM	4
Pd NPs & CNTs	Non-enzymatic	0.5−17 mM	0.2 μM	5
NiO NPs	Non-enzymatic	1–110 μM	0.16 μM	6
Fe_2O_3 nanowires	Non-enzymatic	15μM–8 mM	6 μM	7
Cu nanowires	Non-enzymatic	0.5−17 mM	35 nM	8
Au NRs	Non-enzymatic	0–4 μM	70 nM	This study

Table S2 A comparison of glucose concentration and other carbohydrates (lactose, galactose and mannose) concentration in human plasma.

Carbohydrates	Level	Reference
Lactose	1.5 ± 0.1 μM	9
Galactose	1.48 ± 0.32 μM	10
Mannose	35.6 ± 12.6 μM	11
Glucose	5.2 ± 0.3 mM	12



Elem	Weight %	Atomic %
C K	50.30	88.70
O K	01.20	01.60
AuM	27.10	02.90
AgL	02.20	00.40
CuK	19.20	06.40

Fig.S1 Energy dispersive X-Ray (EDX) spectroscopy of products after GAPS.

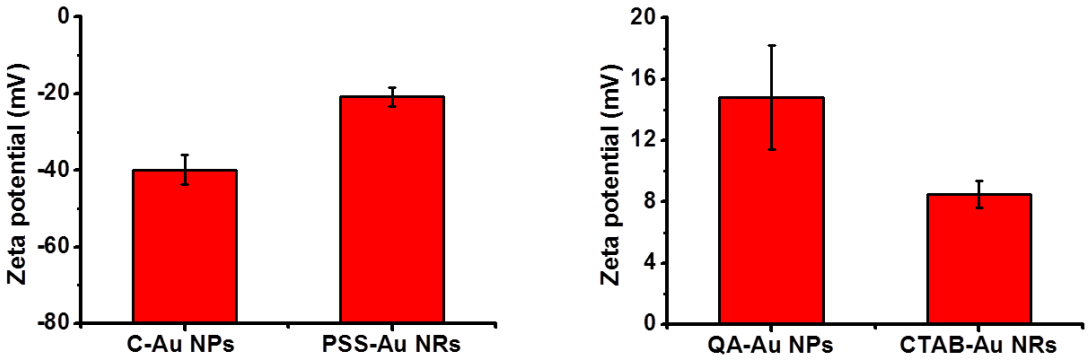


Fig.S2 Zeta potential of PSS-Au NRs and C-Au NPs, CTAB-Au NRs and QA-Au NPs. The error bars represent standard deviation of three measurements.

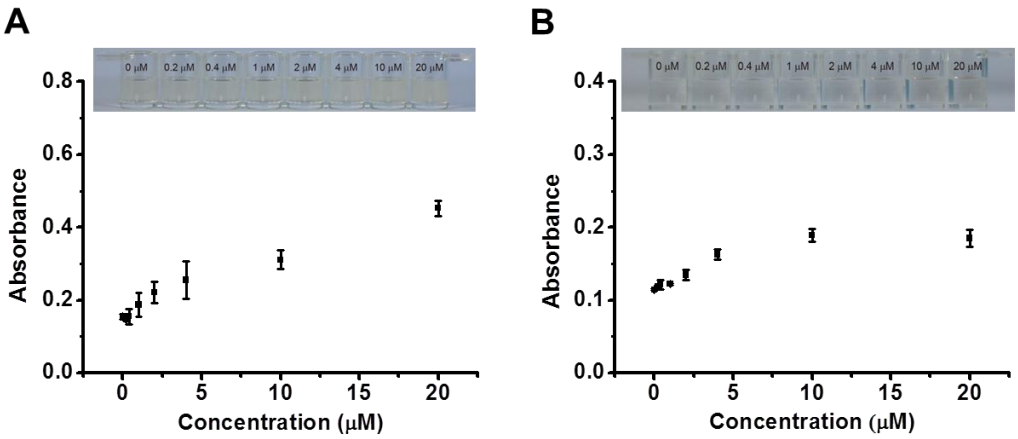


Fig.S3 Performances of glucose assay using (A) CTAB-Au NRs and (B) QA-Au NPs. Absorbance was recorded at 410 nm and the error bars represent standard deviation of four measurements.

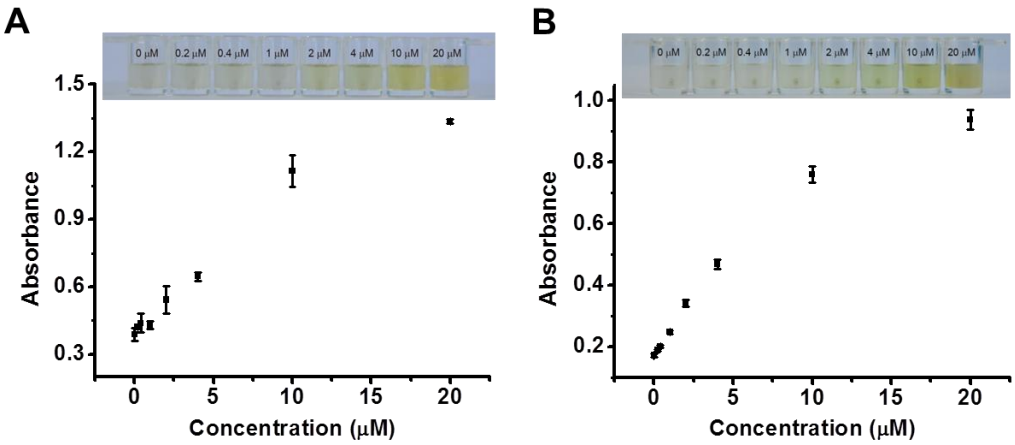


Fig.S4 Performances of glucose assay using (A) PSS-Au NRs and (B) C-Au NPs. Absorbance was recorded at 410 nm and the error bars represent standard deviation of four measurements.

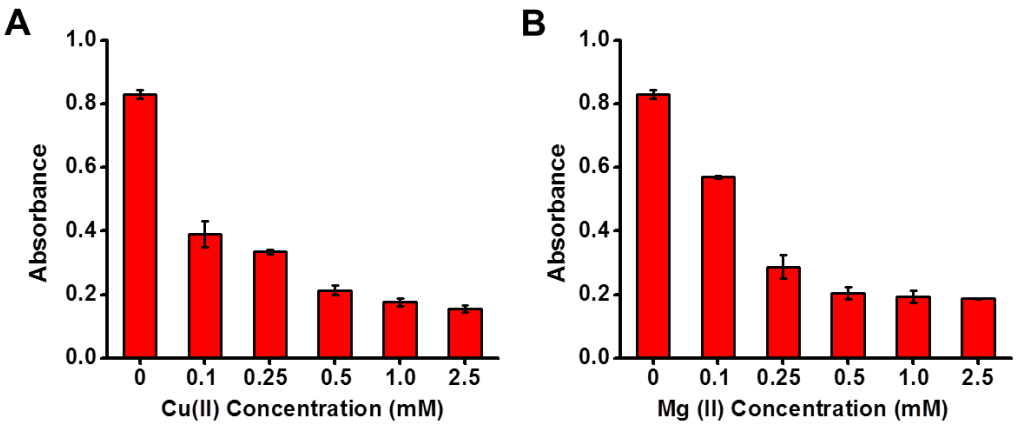


Fig.S5 Addition of Cu^{2+} and Mg^{2+} at different concentrations as the competitors of Ag^{+}. Absorbance was recorded at 410 nm and the error bars represent one standard deviation of four measurements.

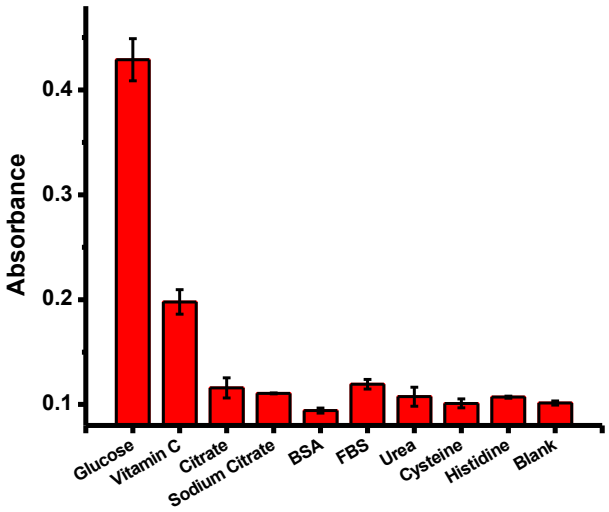


Fig.S6 Interference test of different species on GAPS. Absorbance was recorded at 410 nm and the error bars represent standard deviation of four measurements.

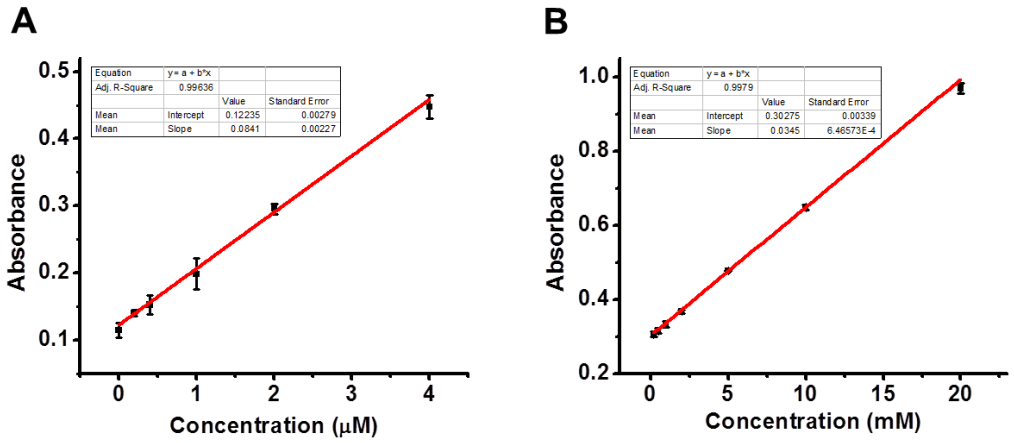


Fig.S7 (A) Calibration curve of GAPS for real sample assay. Absorbance was recorded at 410 nm. (B) Calibration curve of glucose kit (Hexokinase) for real sample assay. Absorbance was recorded at 340 nm. Both the error bars represent standard deviation of four measurements.

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