Supplementary information

Sensitive and bidirectional detection of urine telomerase based on the four detection-color states of difunctional gold nanoparticle probe

Ruixue Duan, Boya Wang, Tianchi Zhang, Zhenyu Zhang, Shaofang Xu, Zhifei Chen, Xiaoding Lou and Fan Xia*

Key Laboratory for Large-Format Battery Materials and Systems, Ministry of Education, School of Chemistry and Chemical Engineering, Huazhong University of Science and Technology (HUST), Wuhan, China.

E-mail: xiafan@hust.edu.cn

Figure S1. **Optimization for difunctional gold nanoparticle probe**

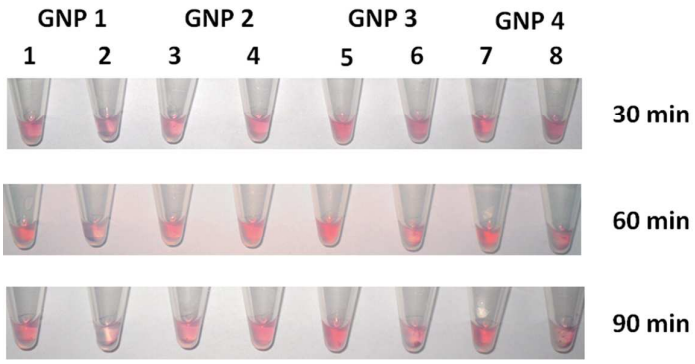

Figure S1. Time course of photo graphs showing colorimetric responses of the different GNP probes to telomerase extracts from tissue. To construct an effective detection system, four different kinds of GNP probes have been prepared firstly according to previous report. They are GNP 1, on which surface the ratio of the primer to reporter probe is 1:9; GNP 2, on which surface the ratio of the primer to reporter probe is 1:4; GNP 3, on which surface the ratio of the primer to reporter probe with poly T is 1:9; GNP 4, on which surface the ratio of the primer to reporter probe with poly T is 1:4. For optimization of the GNP probe, different GNP probes are incubated with extracted telomerase from cancer urine samples in the presence of the nucleotide mixture of dNTP for 2 h at 37 ºC, then 5 min at 95 ºC to deactivate telomerase, finally incubated at 37 ºC again. Telomerase deactivated by heating at 95 ºC for 15 min is used as control samples (1, 3, 5, 7). We have demonstrated the GNP 1 is the most appropriate for this assay with rapid reaction. Therefore, GNP 1 is selected for the following experiments.

Figure S2. **DMSO accelerate the assembly of GNP probes**

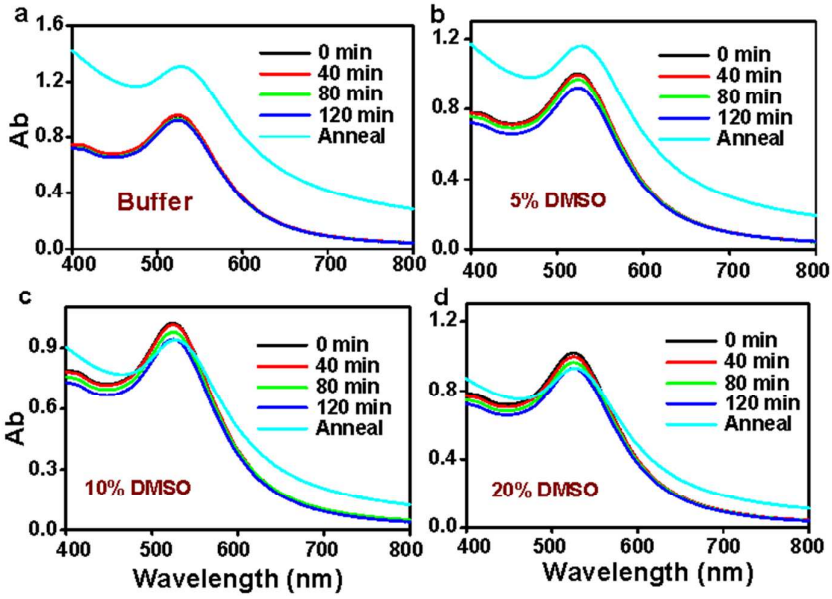

Figure S2. For further understanding and demonstration of the relationship between telomerase and difunctional GNP probe, we challenge our assay with tissue extractions containing 0%, 5%, 10%, and 20% DMSO. Previous study has demonstrated that such low concentration DMSO would not destabilize GNP probes (1). UV-vis spectras of samples are recorded at 40 min, 80 min, 120 min, and after heated at 95 °C for 5 min. In the absence of DMSO, the value of maximal absorption decreases slightly and the characteristic red shift is barely observed until incubation for 120 min at 37 ºC (a). With the increment of the percentage of DMSO, the red shift of GNP can be observed obviously, whereas the value of maximal absorption decreases gradually with the extension of incubation time. As we can see from Figure d, the maximal absorption of sample contained 20% DMSO is reduced even at 40 min. These results demonstrate that the assembly between reporter probe and elongated TS

primer is accelerated with increasing of DMSO concentration at low DMSO percentage (<20%).

Figure S3. **Further demonstration of this proposed method by DMSO**

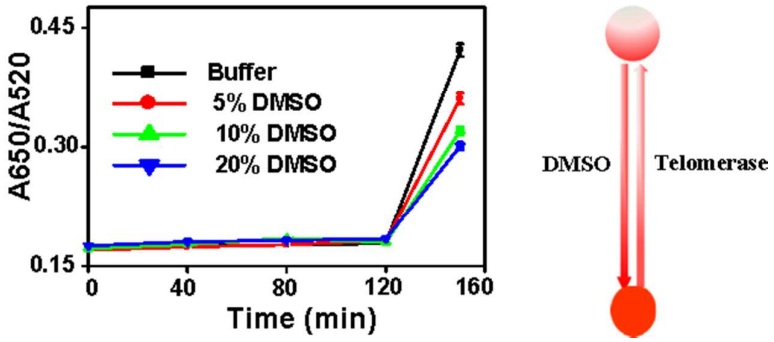

Figure S3. The quantity of precipitated GNP probes is enhanced with the increment of telomerase concentration. It is worth noting that DMSO inhibits telomerase activity and decreases the effective concentration of telomerase because values of A650/A520 reduce by adding DMSO. These results are consistent with our proposed theory, at higher concentration of telomerase (in the forward direction), values of A650/A520 decrease with the reduction of telomerase concentration and the quantity of precipitate. Thus, we successfully demonstrate our strategy by introducing DMSO.

References

(1) Menhaj, A. B.; Smith, B. D.; Liu, J. *Chem. Sci.* **2012**, *3*, 3216-3220.