

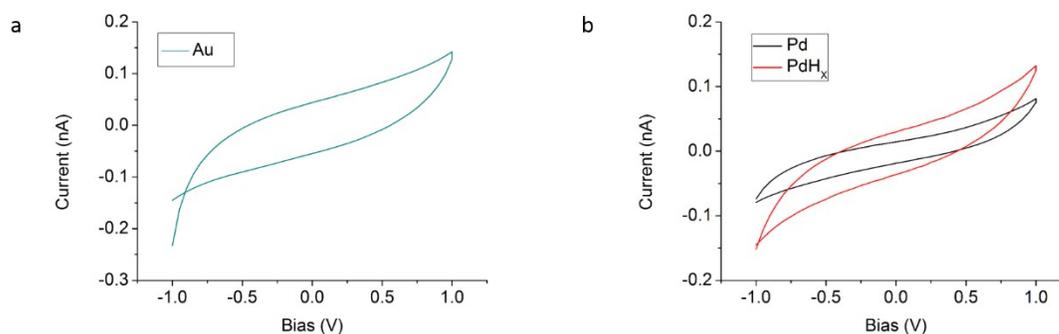
An optically-gated AuNP-DNA protonic transistor

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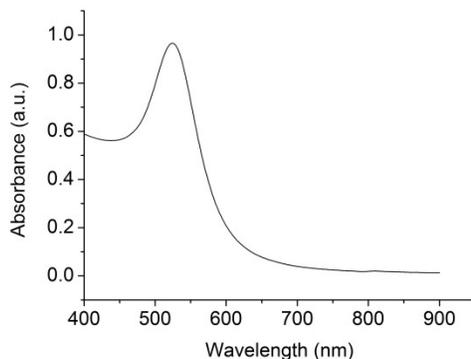
Supporting Information

Electrode Metal	Length (μm)	Width (μm)	Thickness (nm)	Average current at 1V bias (nA, Average \pm Stdev)
Au	3	220	230	0.16 ± 0.05
Pd	3	200	180	0.12 ± 0.03
PdH _x	3	200	180	15.92 ± 1.90

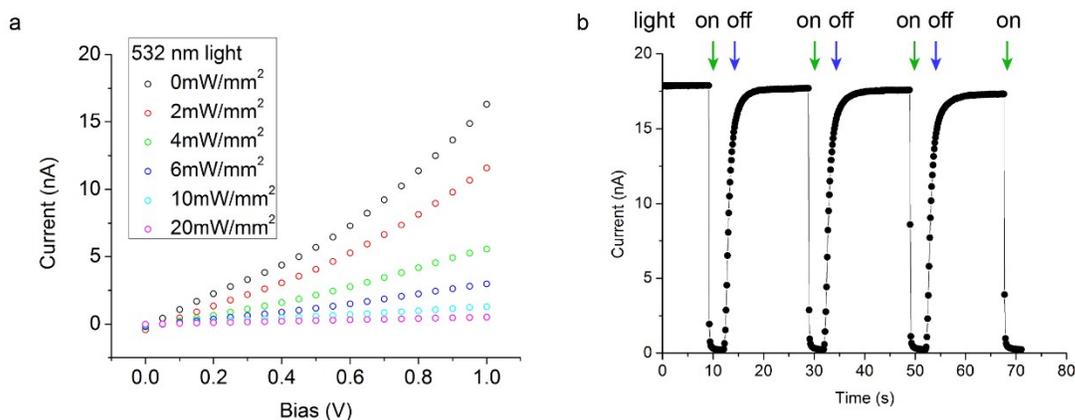
Supporting Table 1: Device dimensions. PdH_x device was obtained by soaking Pd device in H₂ overnight.



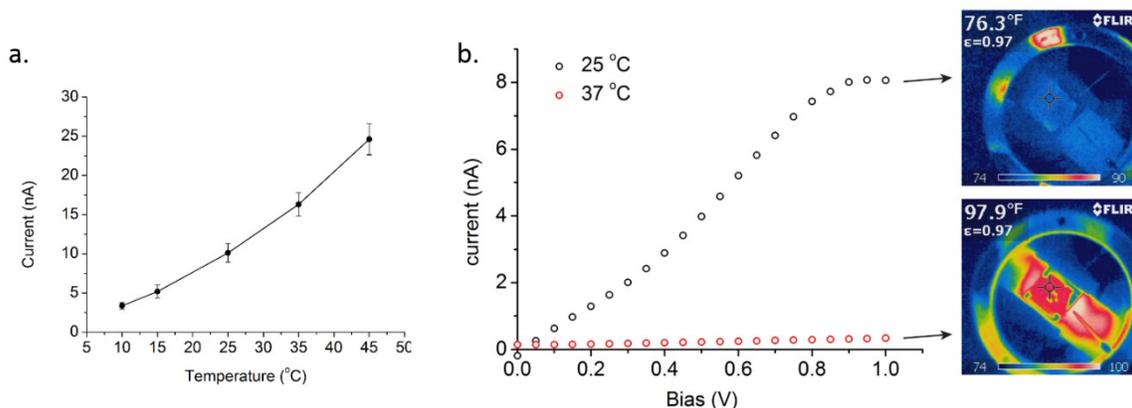
Supporting Figure S1: I-V curve of the (a) AuNP-DNA membrane using Au electrodes, and (b) AuNP-PEG (Thiol mPEG Mw=20 000) membrane using Pd and PdH_x electrode.



Supporting Figure S2: Absorption curve of AuNP-DNA in solution.



Supplementary Figure 3: Reproducibility of AuNP-DNA protonic transistor. **a.** Current response curve to 532 nm light for device with different dimensions (Length \times Width \times Thickness: $3 \mu\text{m} \times 210 \mu\text{m} \times 170 \text{nm}$). **b.** Device current response curve to intermittent 532 nm (20mW/mm^2 , bias was fixed at 1 V) light illumination.



Supplementary Figure 4: Device response to global temperature change and local temperature change. **a.** Device response to global temperature. To change the global temperature, we heated up or cooled down the whole measuring/humidity chamber by using electrical heating belt or ice. The bias was set at 1 V. (Device dimension: Length \times Width \times Thickness: $3 \mu\text{m} \times 140 \mu\text{m} \times 150 \text{nm}$). The data was represented as average \pm standard deviation. **b.** Device response to local temperature. The device was only heated up from the bottom, while the chamber temperature was kept at around 25 $^{\circ}\text{C}$. (Device dimension: Length \times Width \times Thickness: $3 \mu\text{m} \times 150 \mu\text{m} \times 120 \text{nm}$).