Supporting Information

For

MicroRNA-Catalyzed Cancer Therapeutics Based on DNA-Programmed Nanoparticle Complex

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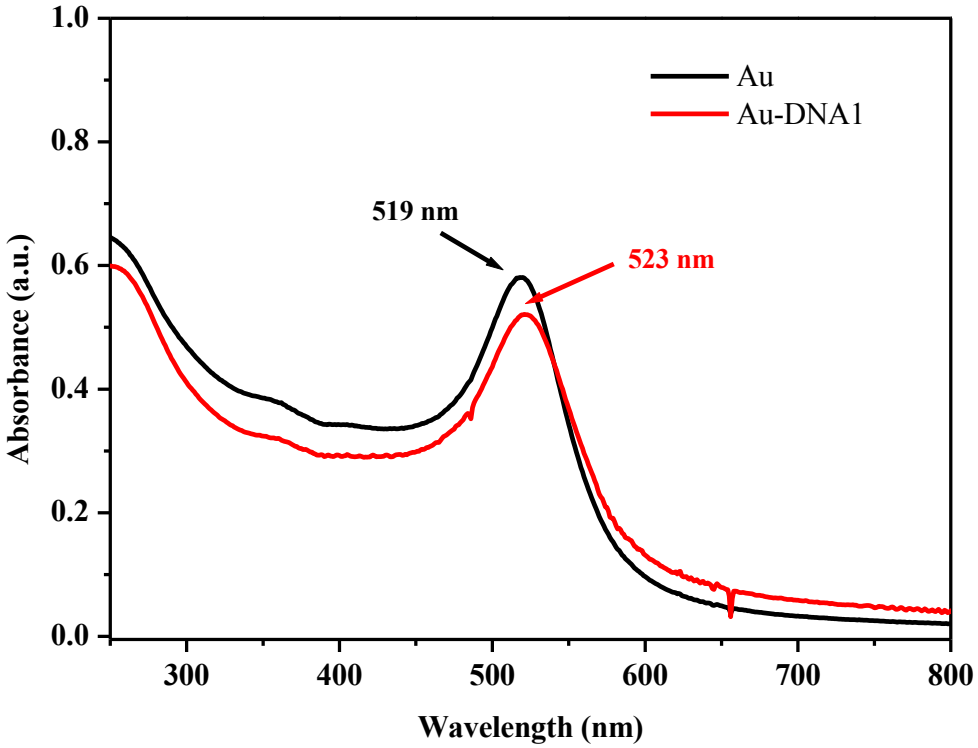


Figure S1. Absorption spectra of GNPs before (black) and after (red) DNA functionalization.

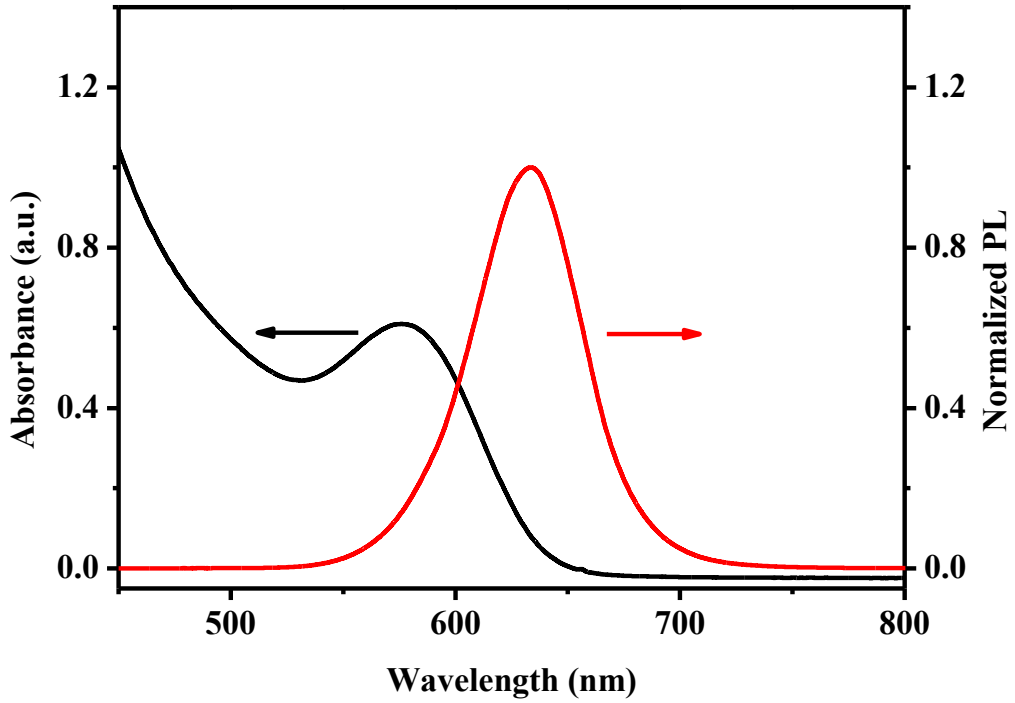


Figure S2. Absorption (black) and photoluminescence (red) spectra of DNA-functionalized CdTe QDs.

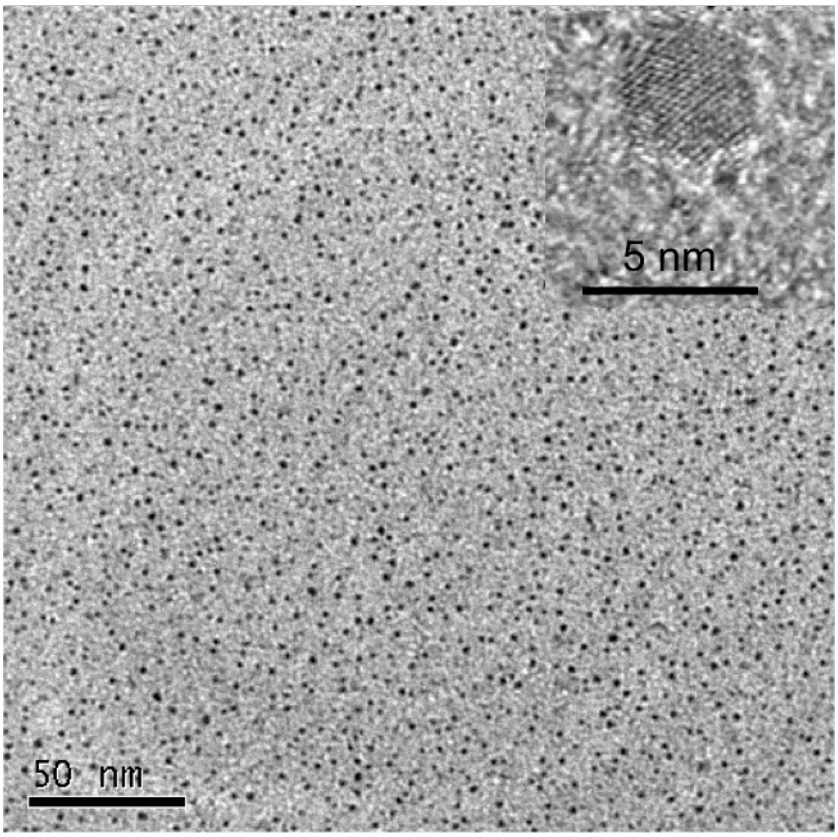
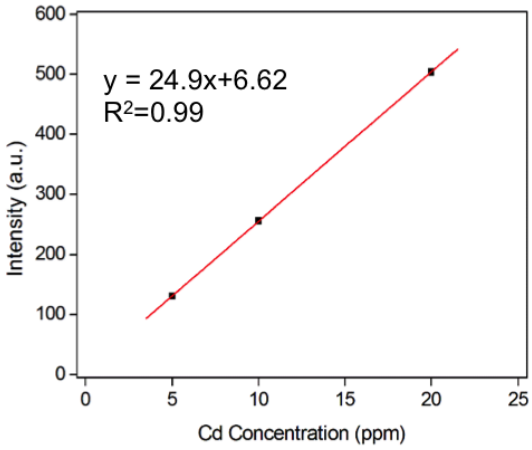
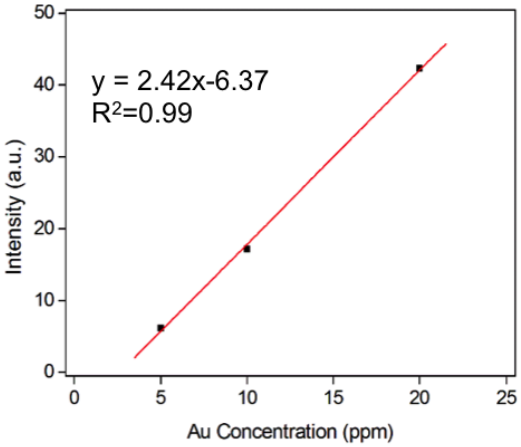


Figure S3. Low magnification and high-resolution TEM images of DNA2-QDs.





element conc.	Intensity(Cd)	Intensity(Au)
5 ppm	130.547	6.188
10 ppm	256.338	17.22
20 ppm	504.194	42.343

NP conc.	Intensity(Cd)	Intensity(Au)
GNP (20 nM)		2183.687
CdTe QD (4 μM)	6288.751	
GNP-QD (unknown)	669.436	2297.424

Figure S4. Related ICP data for determination of the average QD number on each GNP.

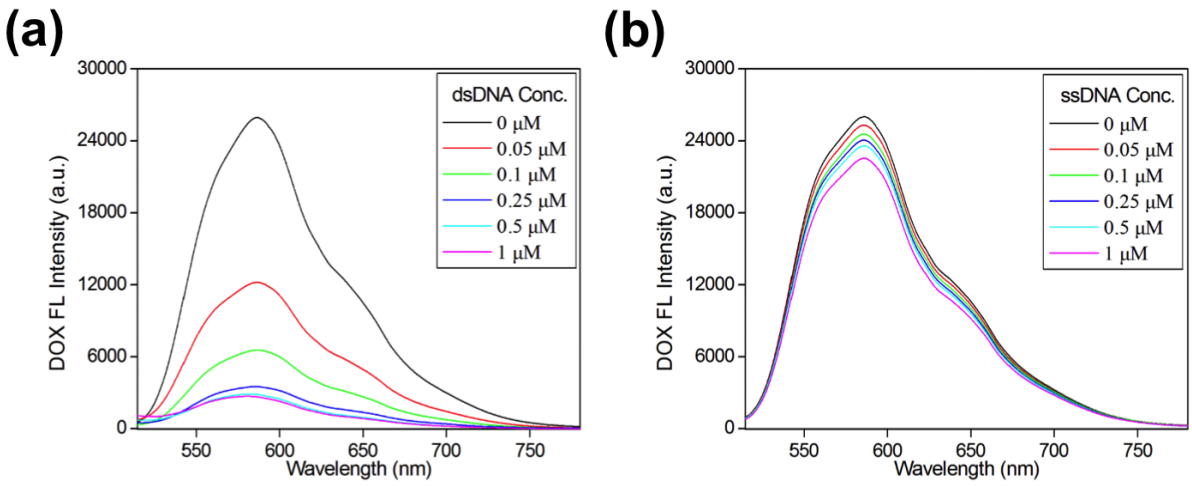


Figure S5. Fluorescence spectra of Dox molecules (1 μM) incubated with different concentrations of ds DNA1-DNA2-Linker DNA (a) and DNA1/DNA2 mixture (b) in 1× PBS at 37 °C for 2 hours.

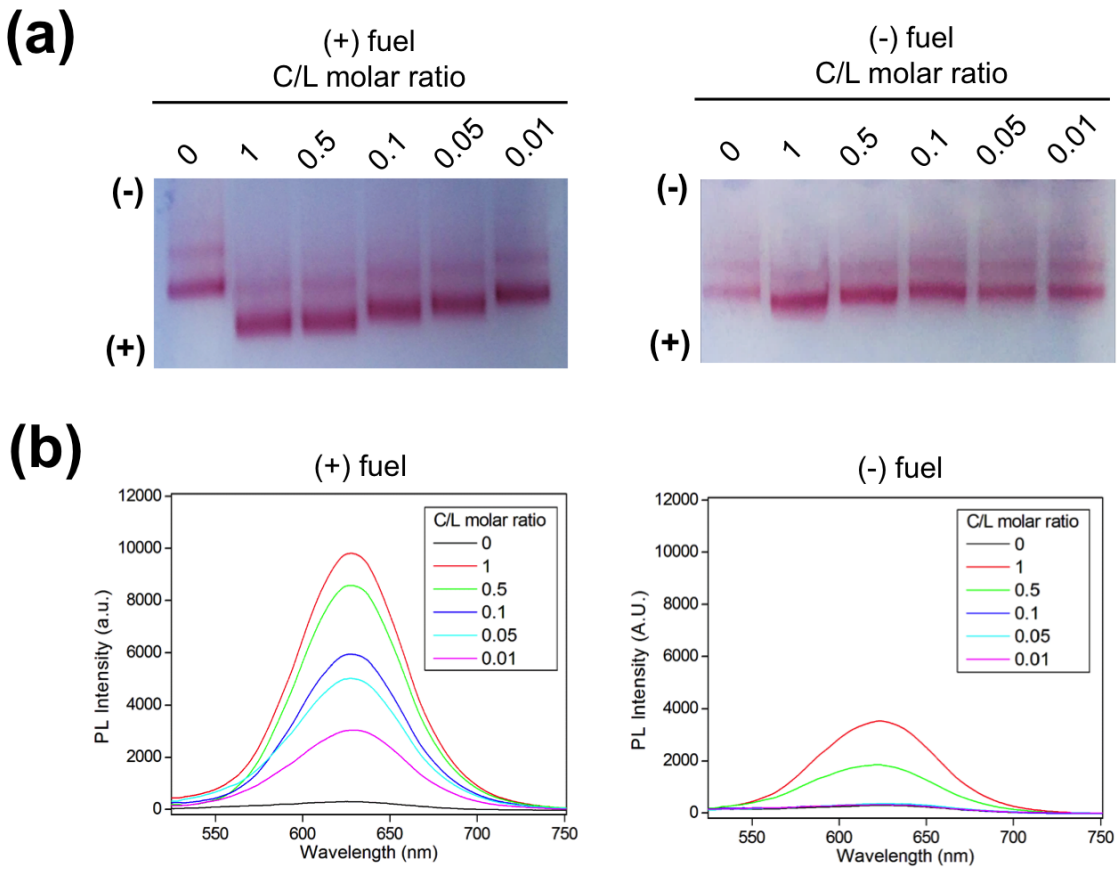


Figure S6. Agarose gel electrophoresis (a) and photoluminescence spectra (b) of GNP-QDs-Dox complex under different catalyst/linker (C/L) molar ratio in the presence (left) or absence (right) of fuel DNA.

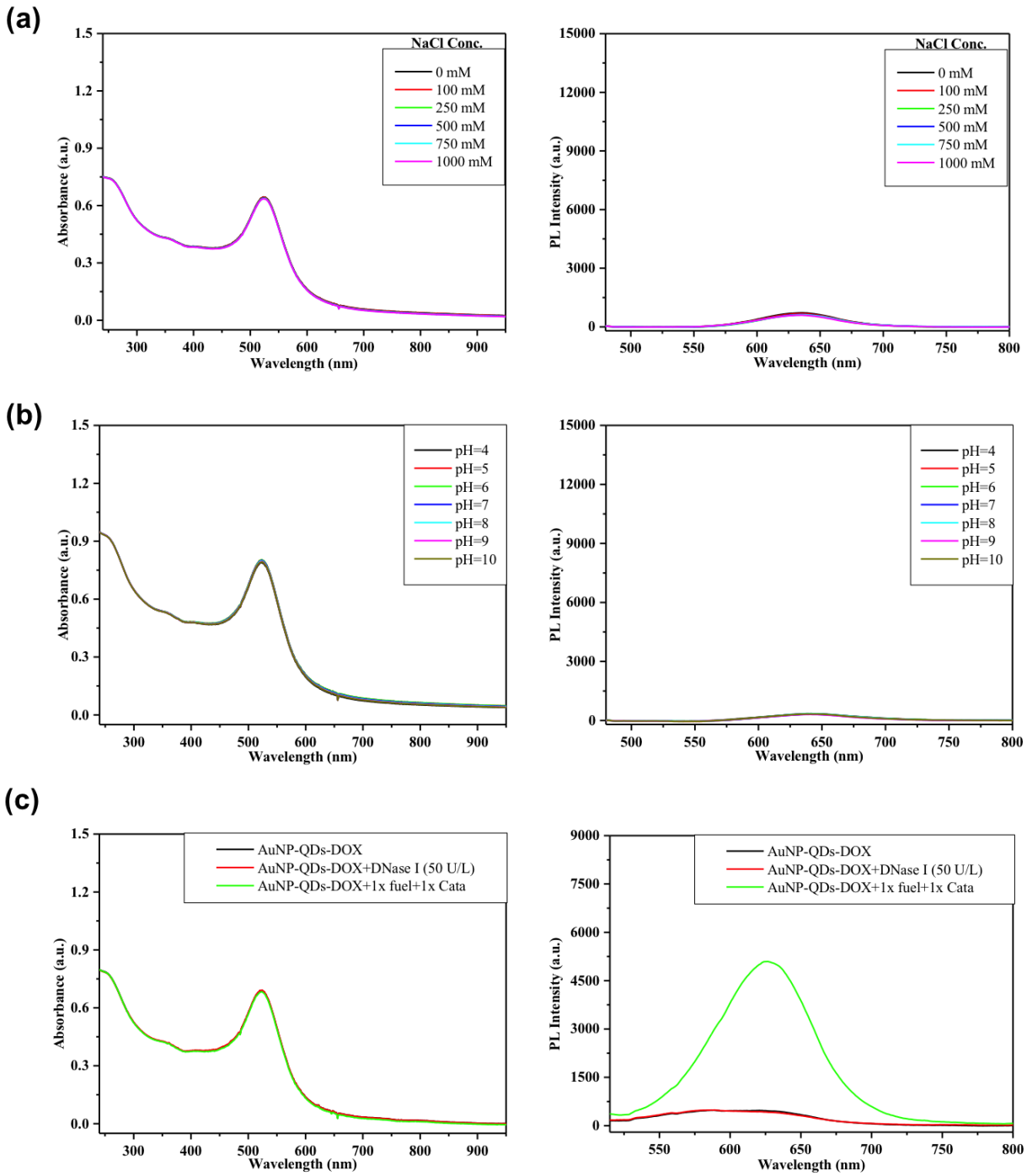


Figure S7. Stability measurements of GNP-QDs-Dox complex. (a) Absorption and photoluminescence spectra of GNP-QDs-Dox complex in different concentrations of NaCl solutions. (b) Absorption and photoluminescence spectra of GNP-QDs-Dox complex at different pHs. (c) Absorption and photoluminescence spectra of GNP-QDs-Dox complex treated with DNase I (50 U/L) or 1× fuel DNA and 1× catalyst DNA.

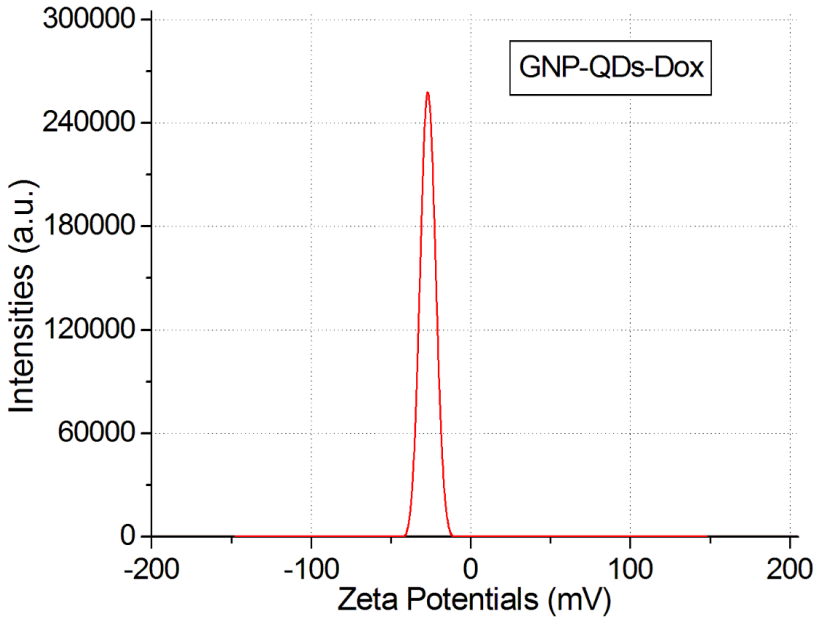
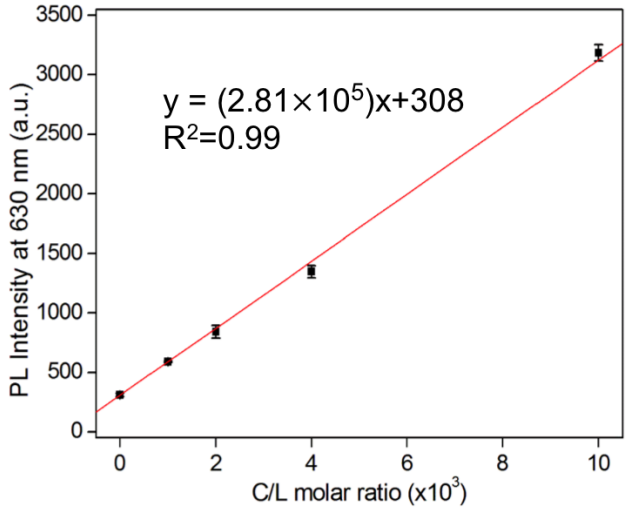


Figure S8. Zeta potential measurement of GNP-QDs-Dox complex.



Cell Type	PL	C'/L	miRNA(nM)	miRNA (mol)	Total RNA (ng)	amol/ng_{RNA}
MCF-7	1199±21	3.17E-03	1.27E-1	1.27E-14	11554	1.10
HeLa	726±18	1.49E-03	5.95E-02	5.95E-15	14211	0.42
HEK-293	334±11	9.25E-05	3.70E-03	3.70E-16	18347	0.02

Figure S9. Measurement of miRNA-21 concentrations in MCF-7, HeLa, and HEK-293 cells. Catalyst DNA with known concentrations is used to generate the standard curve.

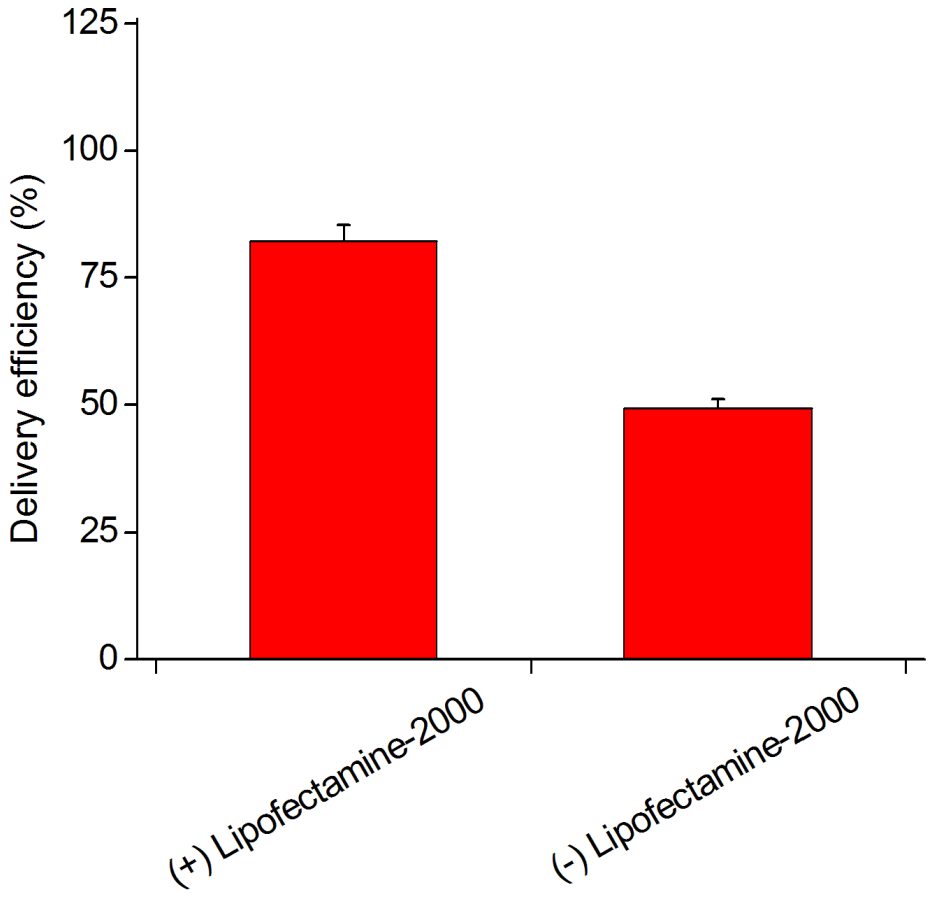


Figure S10. The delivery efficiencies for GNP-QDs-Dox complex in HeLa cells are 82.2% and 49.4% with and without Lipofectamine-2000, respectively.

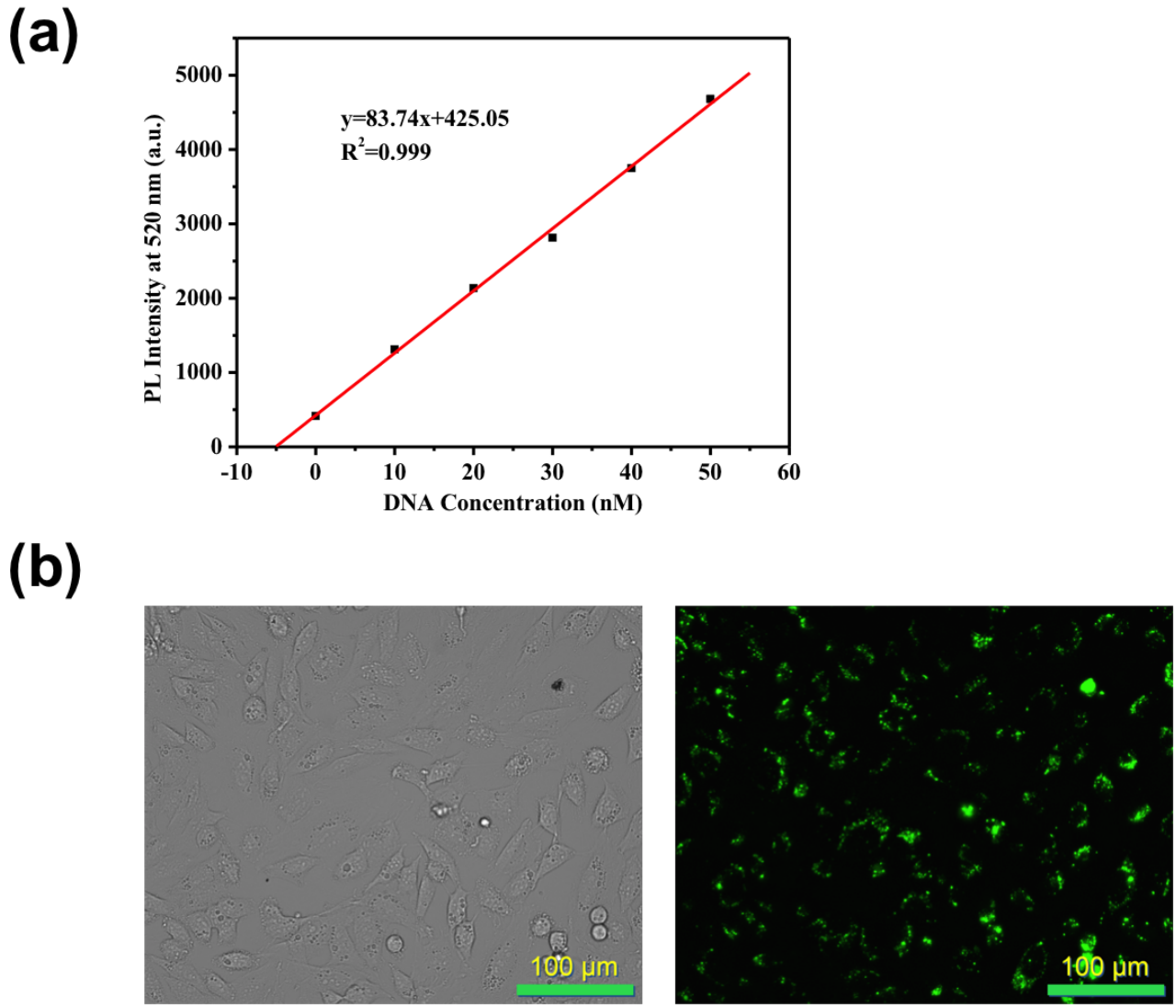


Figure S11. Intracellular delivery efficiency assessment of fuel DNA in HeLa cells. (a) Calibration curve of FAM-labeled fuel DNA. (b) Fluorescence microscopy images of HeLa cells transfected with FAM-labeled fuel DNA using Lipofectamine-2000. The transfection efficiency is determined to be 81%. To determine the amount of transfected fuel DNA, the HeLa cells were lysed and the concentration of FAM-labeled fuel DNA was determined by fluorescence spectroscopy using the calibration curve.

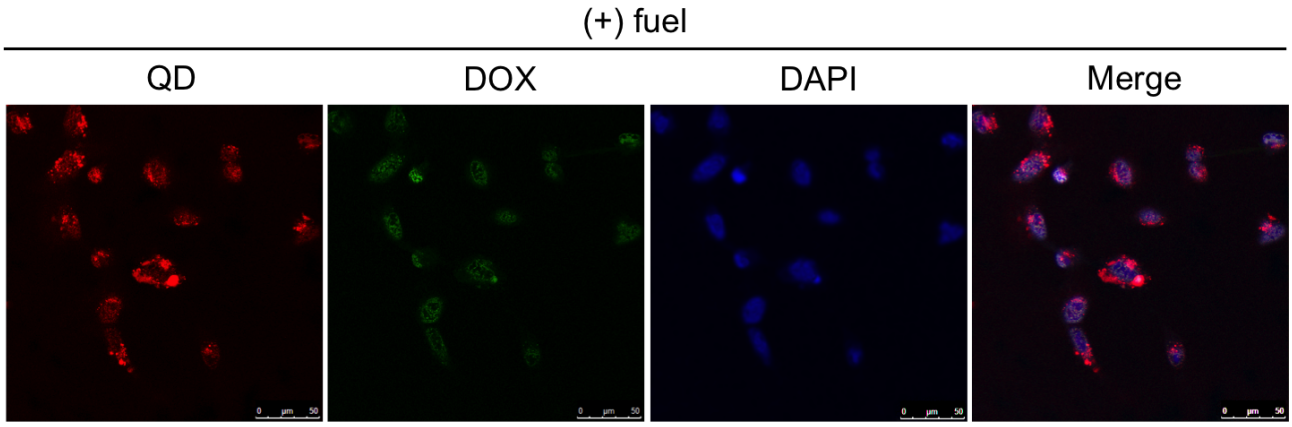
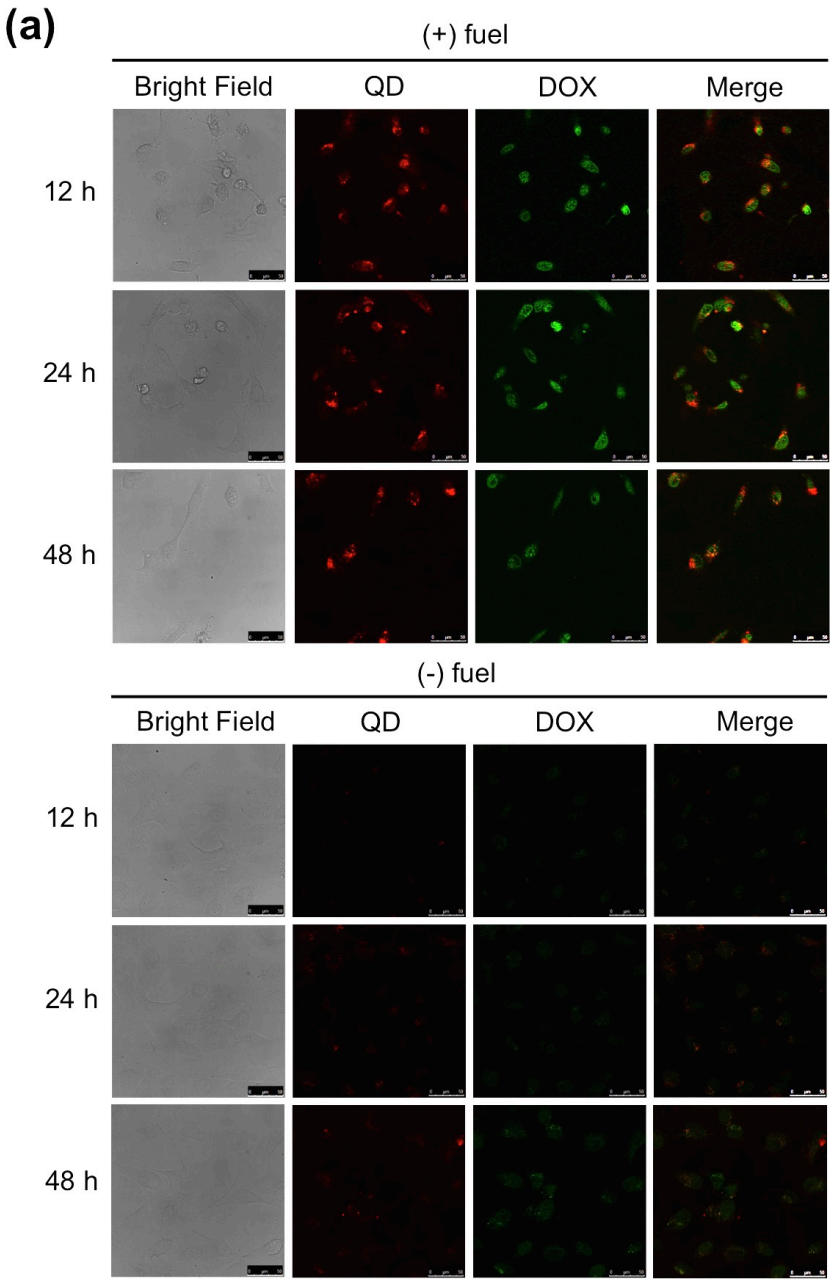


Figure S12. Confocal microscopy images and co-localization study of live HeLa cells transfected with fuel DNA and GNP-QD-Dox complex and stained with DAPI. The Dox signal and DAPI signal were highly co-localized, confirming that the released Dox molecules translocated to cell nucleus. 20 μL DAPI (10 μg/mL) in 200 μL DMEM were used for nucleus staining. The fluorescence images of the cells were captured on a Leica TCS SP5 II confocal laser scanning microscope using a 63× oil immersion objective. QDs, Dox, DAPI molecules were excited at 405 nm, 488 nm, and 405 nm respectively. And their emission signals were collected between 620-650 nm, 570-600 nm, and 450-480 nm respectively.


(a)
(+) fuel
Bright Field
QD
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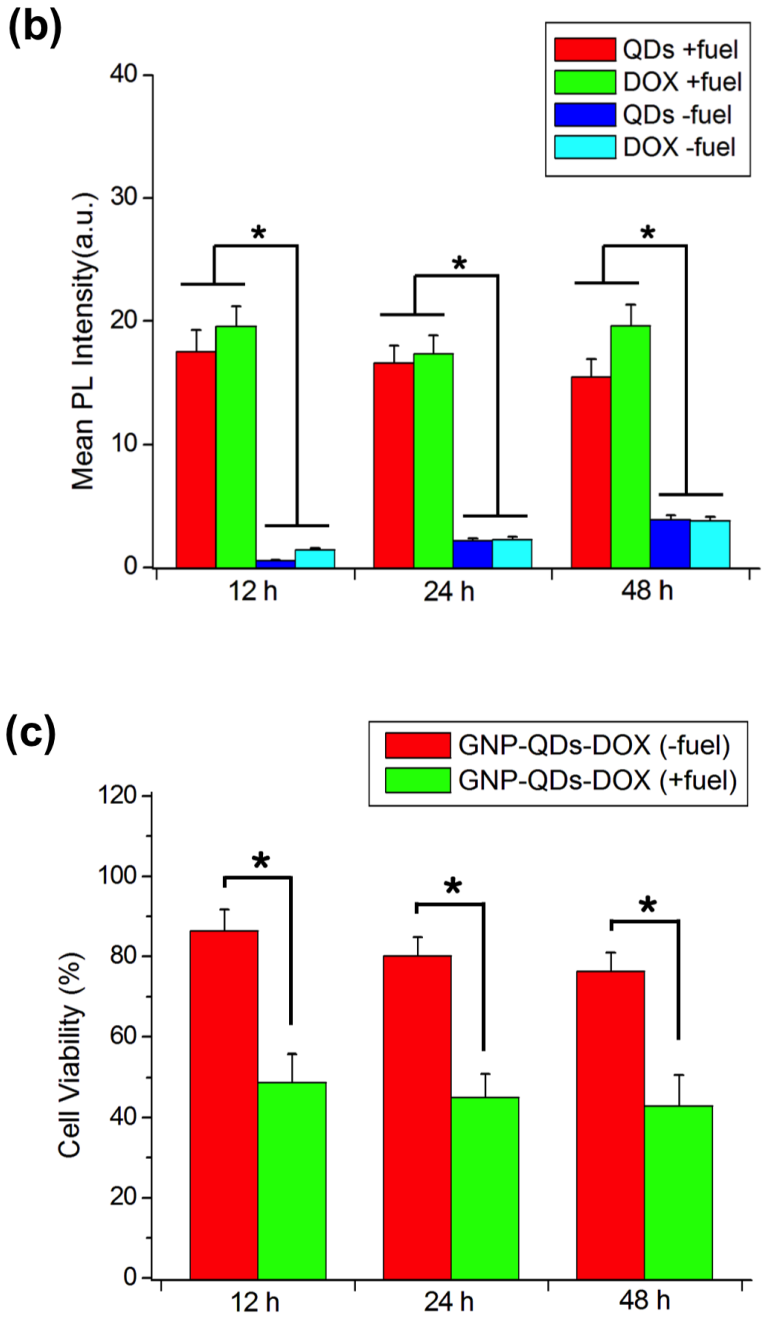

Figure S13. Confocal microscopy (a), mean cell fluorescence intensities (b), and cytotoxicity studies (c) of HeLa cells treated with GNP-QDs-Dox complex in the presence or in the absence of fuel DNA for 12, 24, and 48 hours. (scale bars = 50 μm; student's t-test, *$p < 0.01$)

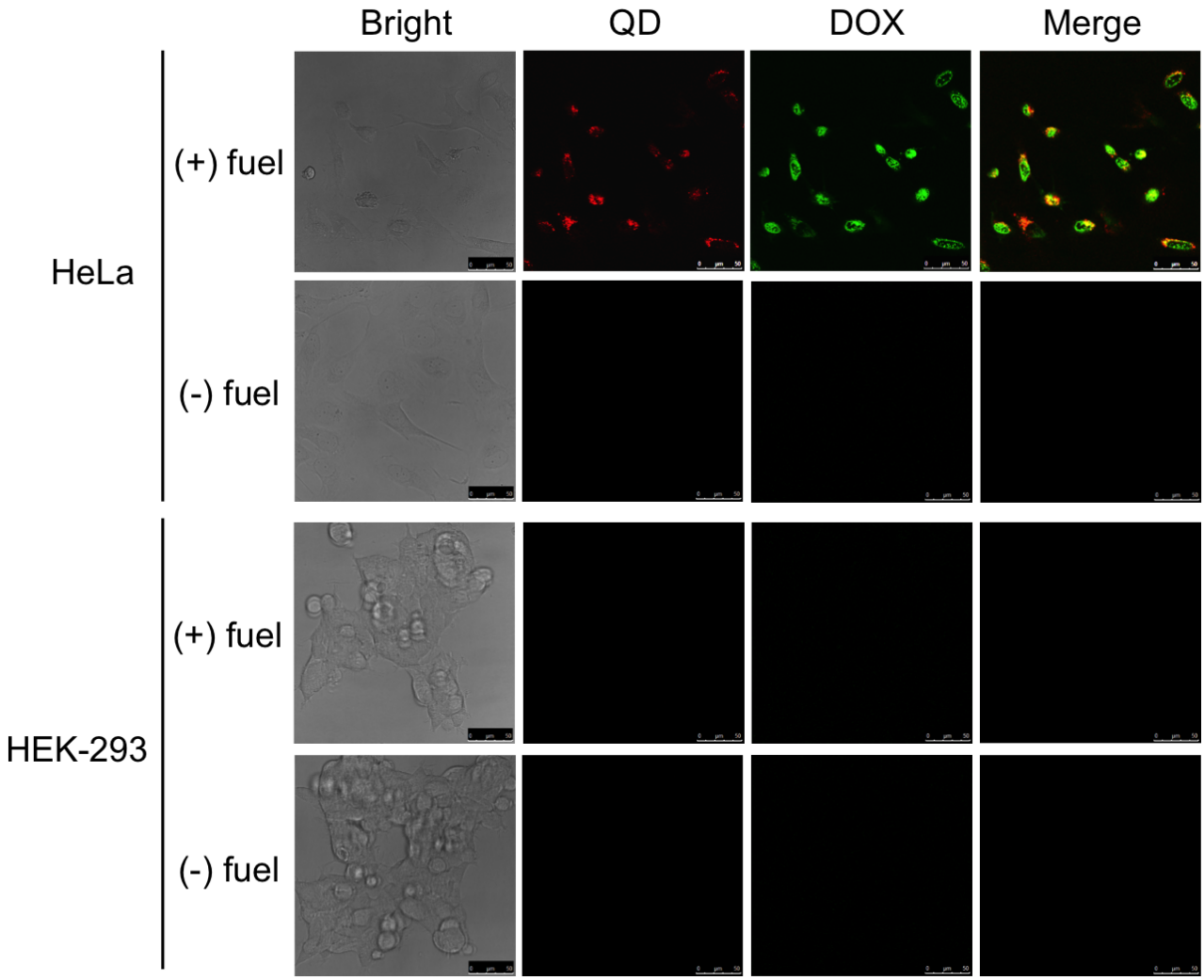

Figure S14. Confocal microscopy images of live HeLa and HEK-293 cells treated with GNP-QDs-Dox complex in the presence or in the absence of fuel DNA. (Red: QD signal; Green: Dox signal; scale bars = 50 μm)