SUPPORTING INFORMATION

Controllable Mitochondrial Regulation Based on Photo-Triggered DNA Circuitry

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Table S1 Sequences of DNA used in this project.

T1	**GCACGTCCACGGTGTCGCTTGAAT**
H1	ATTCAAGCGACACCGTGGACGTGCACCCACGCACGTCCACGGTGTCGCACC
H2	GTTGCACGTCCACGGTGTCGCTTGAATGCGACACCGTGGACGTGCGTGGGT
IH	**GCACGTCCACGGTGTCGCTTGAAT/ipclink/GGTGCGACACCGTGGACGTGCAAC**
H1-azd	ATTCAAGCGACACCGTGGACGTGCACCCACGCACGTCCACGGTGTCGCACC-Azide
H2-azd	Azide-GTTGCACGTCCACGGTGTCGCTTGAATGCGACACCGTGGACGTGCGTGGGT
H2-FAM	GTTGCACGTCCACGGTGTCGCTTGAATGCGACACCGTGGACGTGCGTGGGT-FAM

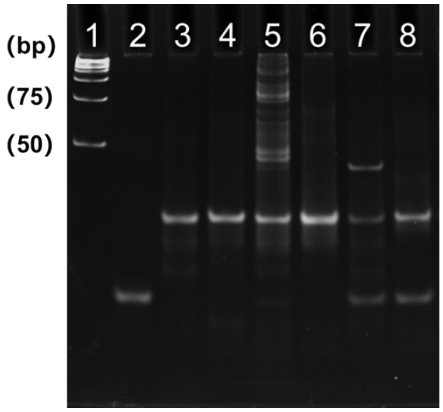

Fig. S1 Native PAGE (10% wt.) analysis of the HCR initiated with single-stranded DNA. In a typical experiment, T1 (5 μM) was mixed with H1 (10 μM) and H2 (10 μM), and incubated at room temperature for 4 h. Lane 1−8: DNA ladder maker, T1, H1, H2, T1+H1+H2, H1+H2, T1+H1, T1+H2.

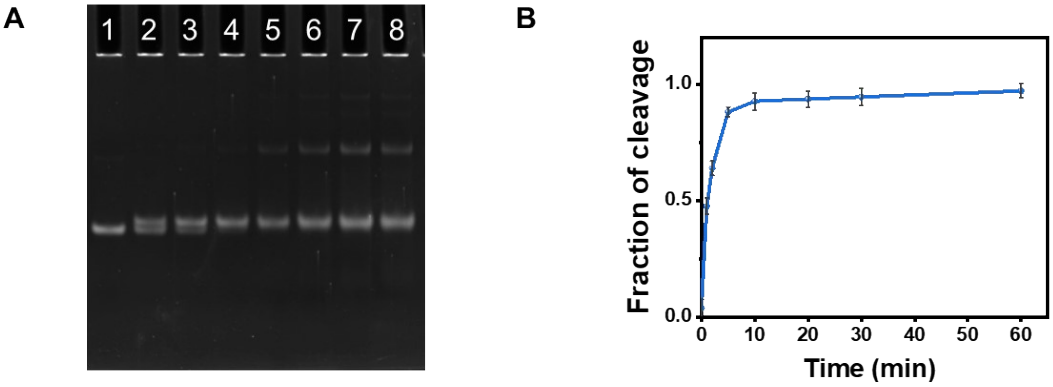

Fig. S2 Photocleavage experiments. **(A)** Native PAGE (10 wt.%) analysis of the IH under 0, 1, 2, 5, 10, 20, 30 and 60 min of UV irradiation. **(B)** Plot of photocleavage fraction versus UV irradiation time.

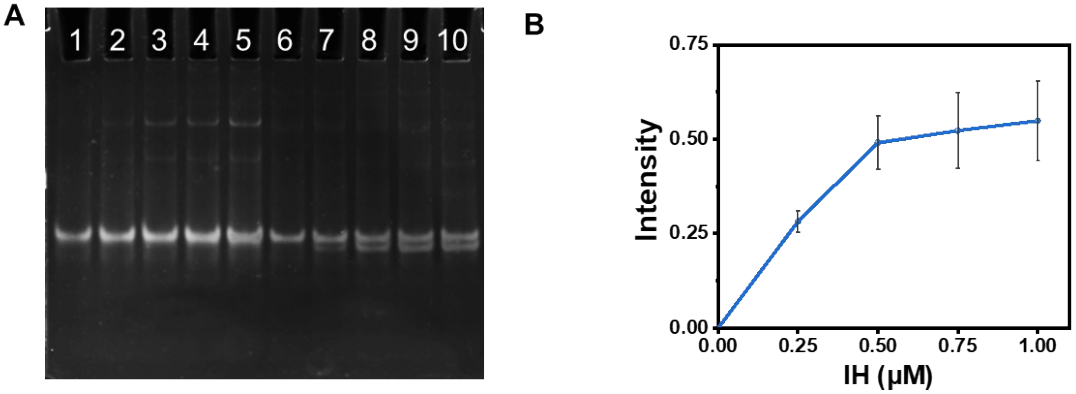

Fig. S3 Optimization experiments for PHCR. **(A)** Native PAGE (10 wt%) analysis of the PHCR. In Lanes 1−5 (10-min irradiation) and 6−10 (no irradiation), the concentrations of IH were 0 (Lane 1, 6), 0.25 (Lane 2, 7), 0.5 (Lane 3, 8), 0.75 (Lane 4, 9), and 1 μM (Lane 5, 10), which mixed with H1 (1 μM) and H2 (1 μM) for overnight reaction at room temperature. **(B)** Plot of gray levels against the concentration of IH in (A).

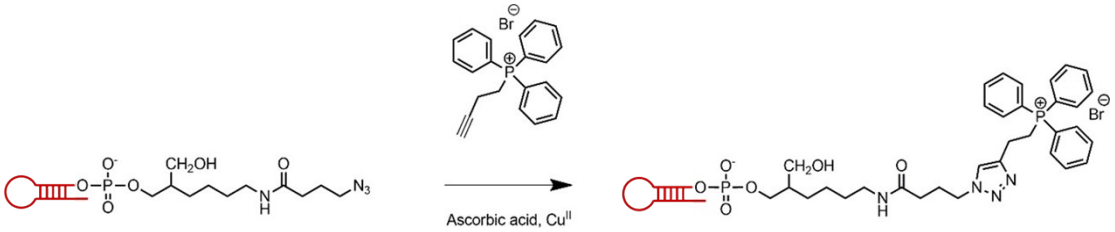

Fig. S4 Synthetic route of H1-TPP and H2-TPP.

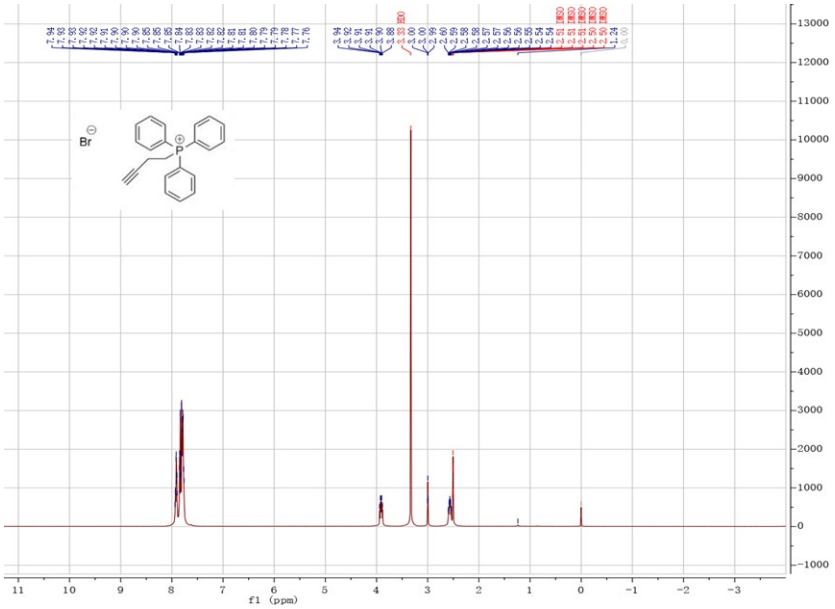

Fig. S5 ^{1}H-NMR spectrum of alkynyl-TPP.

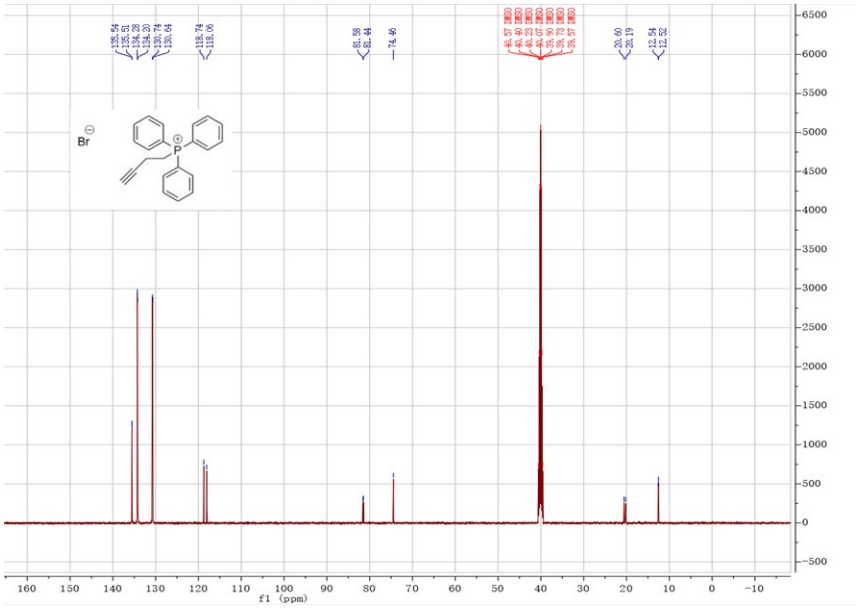

Fig. S6 ^{13}C-NMR spectrum of alkynyl-TPP.

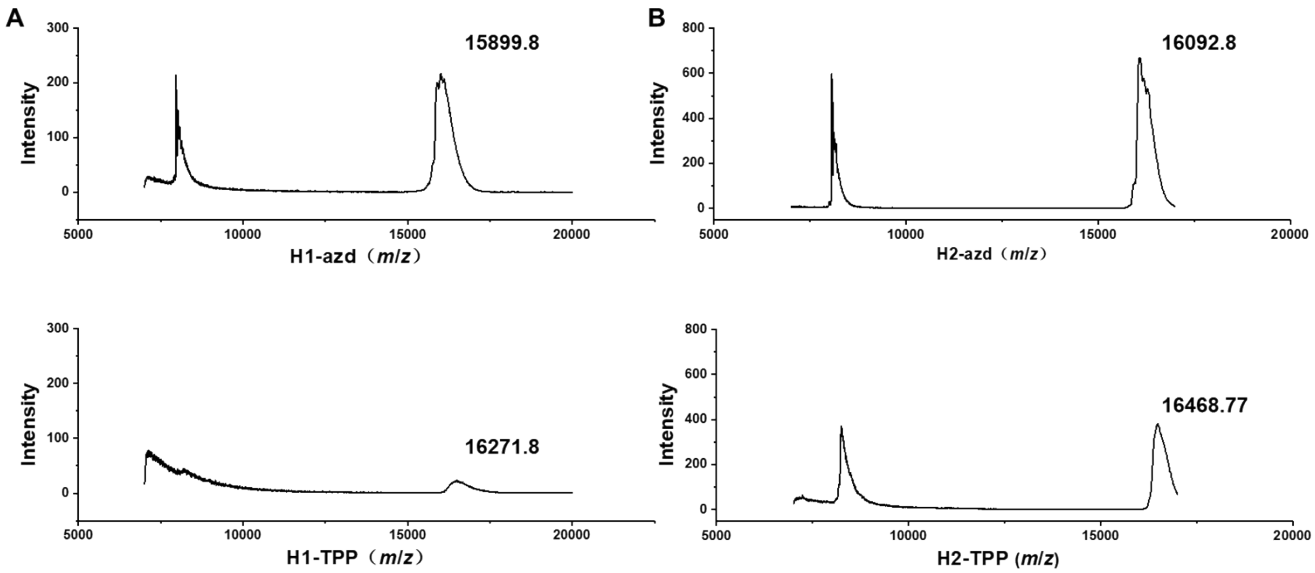

Fig. S7 MALDI-TOF MS spectra of **(A)** H1-azd and H1-TPP, and **(B)** H2-azd and H2-TPP.

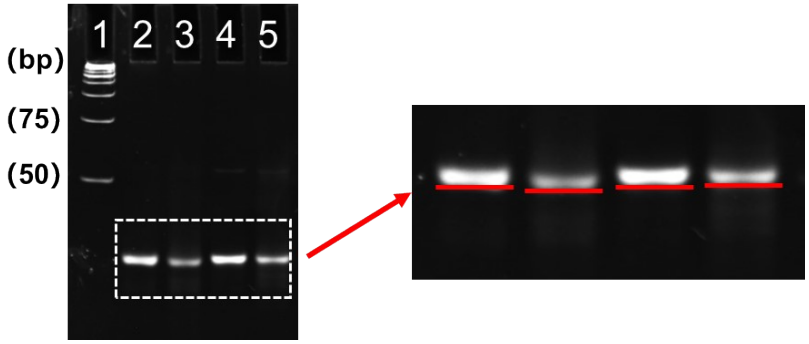

Fig. S8 Native PAGE (20 wt.%) analysis of the TPP-conjugated hairpins. Lane 1−5 represent DNA ladder maker, H1-azd, H1-TPP, H2-azd, H2-TPP.

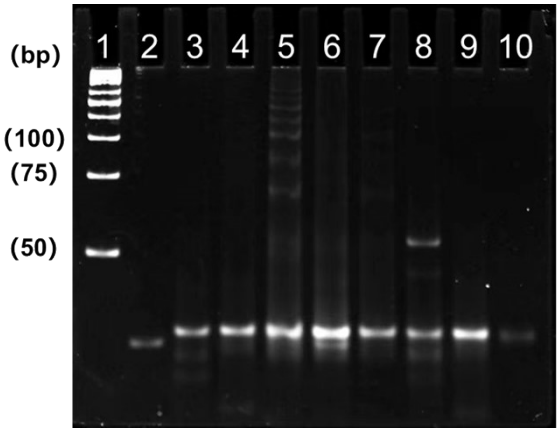

Fig. S9 Native PAGE (10 wt.%) analysis of the photo-controlled HCR by using H1-TPP and H2-TPP. In a typical experiment, IH (5 μM) was mixed with H1-TPP (10 μM) and H2-TPP (10 μM), and incubated at room temperature for 4 h. Lane 1−10 represent DNA ladder maker, IH, H1-TPP, H2-TPP, IH+H1-TPP+H2-TPP with 10 min UV irradiation, IH+H1-TPP+H2-TPP, H1-TPP+H2-TPP, IH+H1-TPP with 10 min UV irradiation, IH+H2-TPP with 10 min UV irradiation, IH with 10 min UV irradiation.

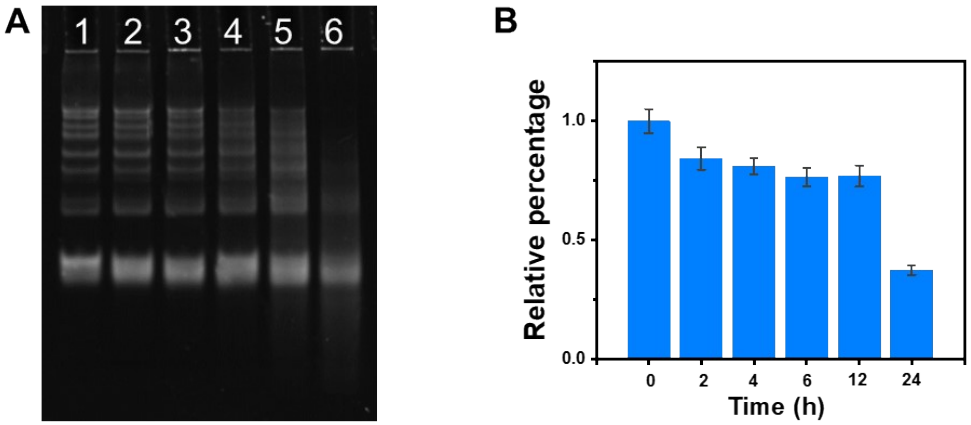

Fig. S10 (A) The stability of HCR products incubated in 10 wt.% fetal bovine serum (FBS) for 0 h (Lane 1), 2 h (Lane 2), 4 h (Lane 3), 6 h (Lane 4), 12 h (Lane 5) and 24 h (Lane 6), and then analyzed with 10 wt.% denatured PAGE, and **(B)** Gray levels of the bands in (A).

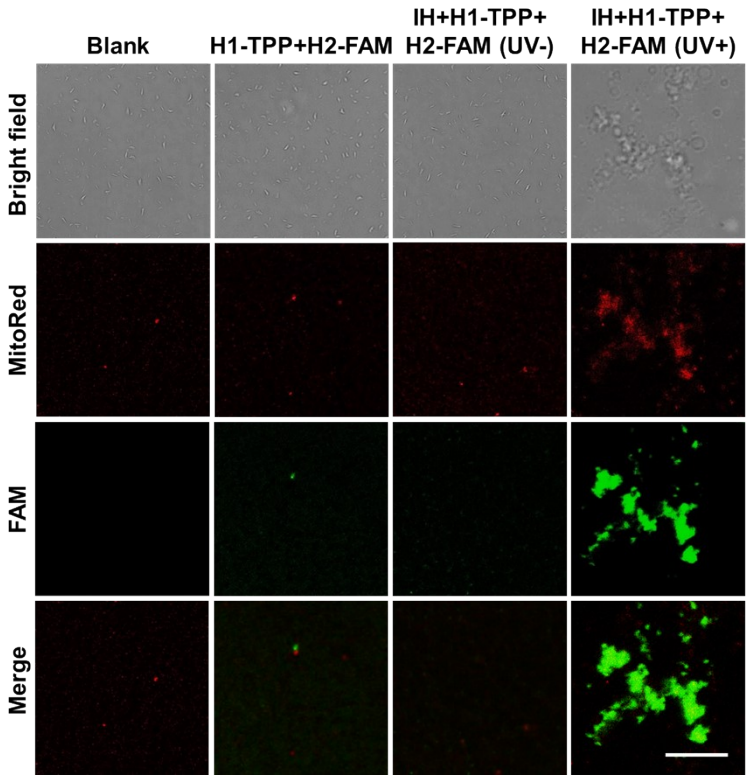

Fig. S11 Confocal epifluorescence study of extracellular mitochondria (blank) after treated with H1-TPP and H2-FAM, IH+H1-TPP+H2-FAM, IH+H1-TPP+H2-FAM irradiated for 10 min at room temperature, respectively. Scale bar: 5 μm.

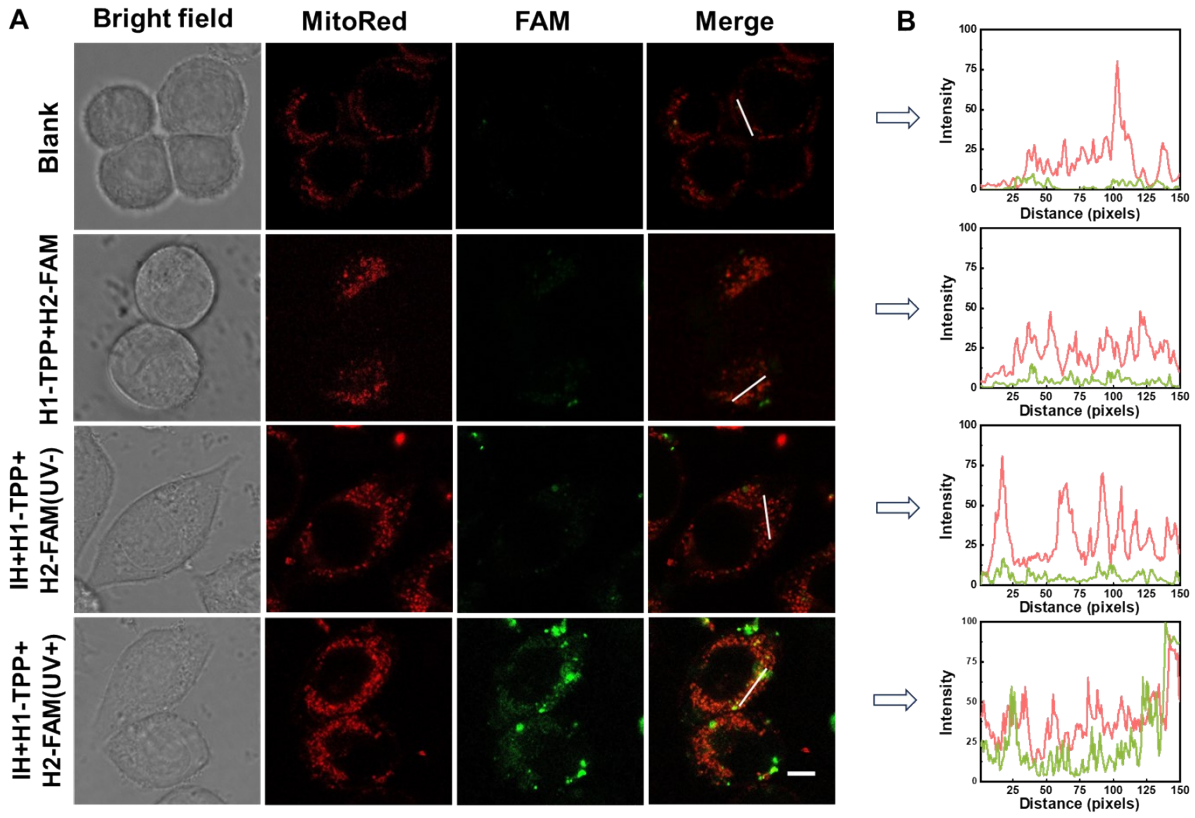

Fig. S12 (A) Intracellular colocalization of FAM (green)-labeled H2 with mitochondria (red) in 4T1 cells incubated without (Blank) and with H1-TPP and H2-FAM, and IH, H1-TPP and H2-FAM, with and without 10-min irradiation. Scale bar: 10 μm. **(B)** Fluorescence intensity profile of MitoRed and FAM at the arrowed white line of interest in the Merge row of (A).

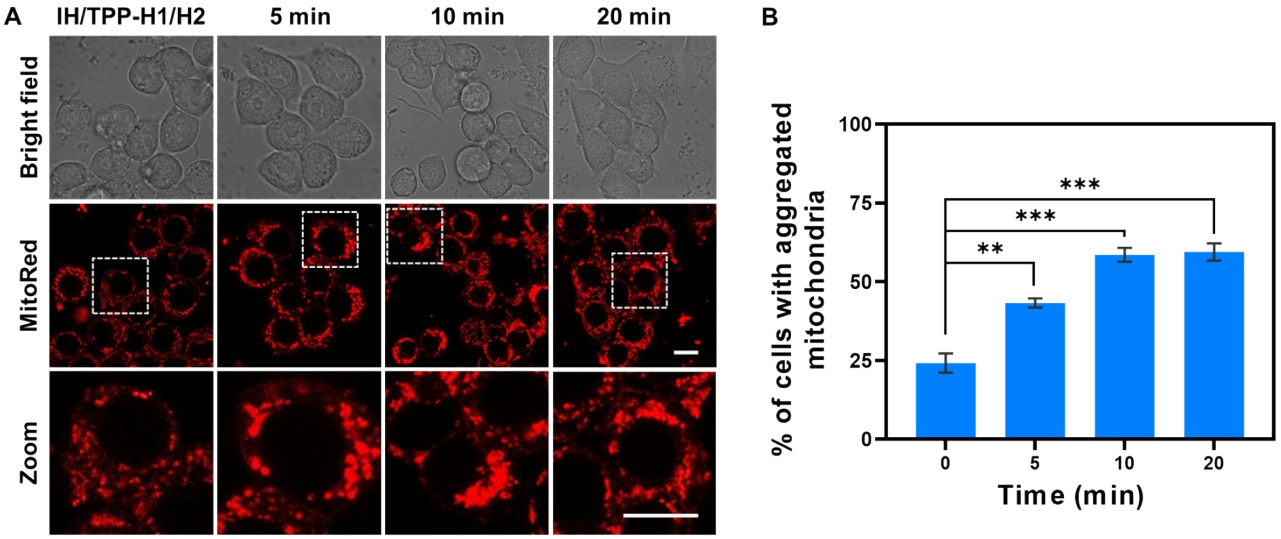

Fig. S13 Confocal epifluorescence images of 4T1 cells treated with IH/TPP-H1/H2 under UV irradiation at different period. Scale bar: 20 μm

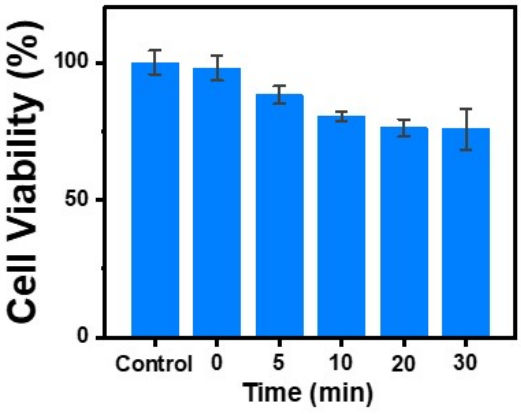

Fig. S14 Cell viability of 4T1 cells in the absence (Control) and presence of TPP-HCR systems (500ng) during different exposure to UV irradiation. Shown are means ± standard deviation (S.D., n = 3).

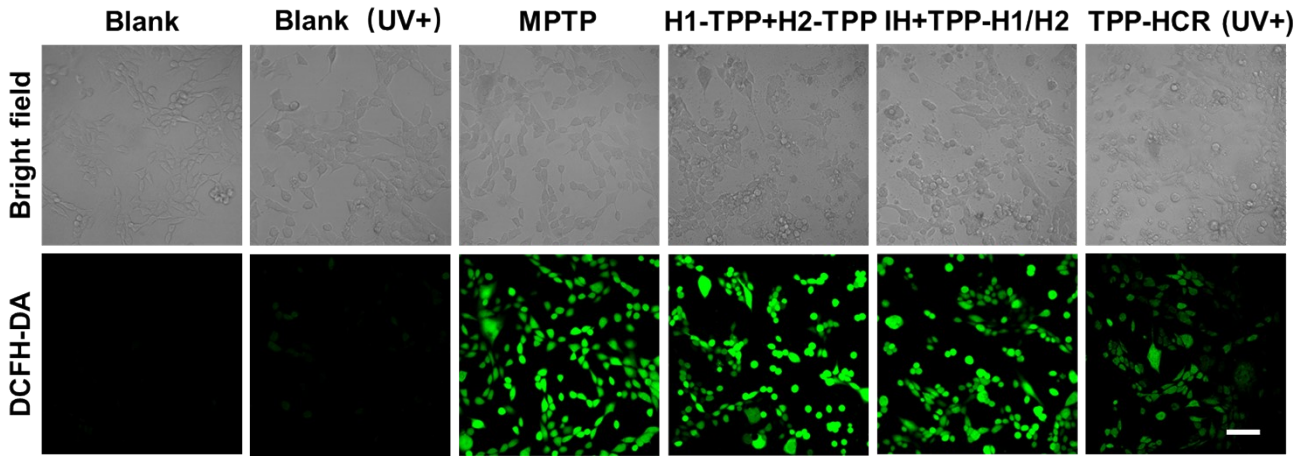

Fig. S15 Intracellular ROS measurement in blank and 1 mM MPTP-pretreated 4T1 cells with or without the addition of 1-μg H1-TPP and H2-TPP, as well as 1 μg TPP-HCR in the presence and absence of 10-min UV irradiation for 24 h at 37 °C.

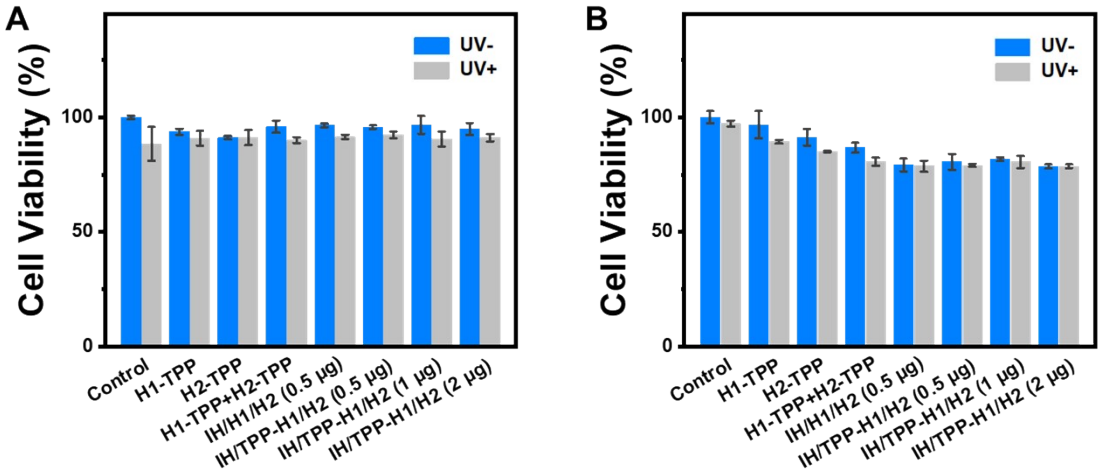

Fig. S16 Cytotoxicity of DNA mixtures. Cell viabilities of **(A)** 4T1 and **(B)** Hela cells in the absence (Control) and presence of different concentrations of DNA mixtures with or without 10 min irradiation. The data error bars indicate means ± S.D. (n = 3).