Supporting Information

Mitochondria-based aircraft carrier enhances*in vivo* imaging of carbon quantum dots and delivery of anticancer drug

*Wen-Qing Li†,§, Zhigang Wang†,§, SijieHao†,§, Liping Sun†, MerisaNisic†, ‡, Gong Cheng†, Chuandong Zhu†, ‖, Yuan Wan†, Laura Ha†, and Si-Yang Zheng†,‡,**

†Department of Biomedical Engineering, Penn State Materials Research Institute, ‡The Huck Institutes of the Life Sciences, Penn State Hershey Cancer Institute, Department of Electrical Engineering, The Pennsylvania State University, University Park, PA 16802, U.S.A.; ‖The Second Hospital of Nanjing, Affiliated to Medical School of Southeast University, Nanjing, China, 210003.

§Authors with equal contributions

*** Corresponding Author:**

Si-Yang Zheng, Ph.D.

N-238 Millennium Science Complex

The Pennsylvania State University, University Park, PA 16802

Tel: 1-(814) 865-8090

Email: sxz10@psu.edu

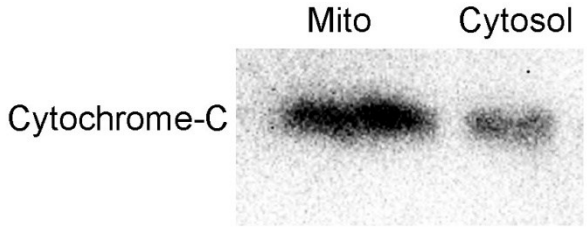


Fig S1. Western blot of Cytochrome-C in the mitochondria (Mito) and cytosol.

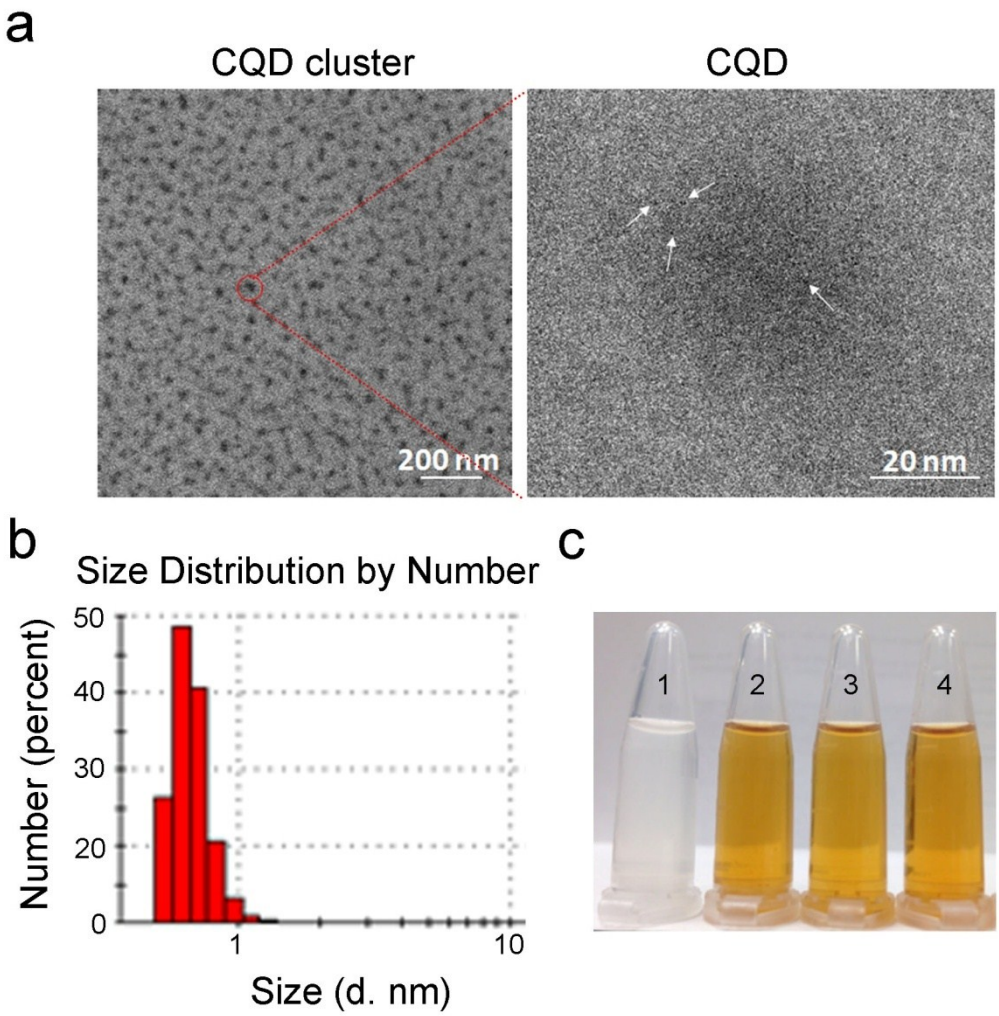


Fig S2. Characterizations of CQD.(a)TEM images of CQD at low magnification and high magnification.(b)Diameter distribution of CQD measure by dynamic light scattering(DLS).**(c)**Photos of gelatin solution (1), raw CQD suspension (2), and ultrafiltration supernatant at MWCO 100KDa (3), 10KDa (4).

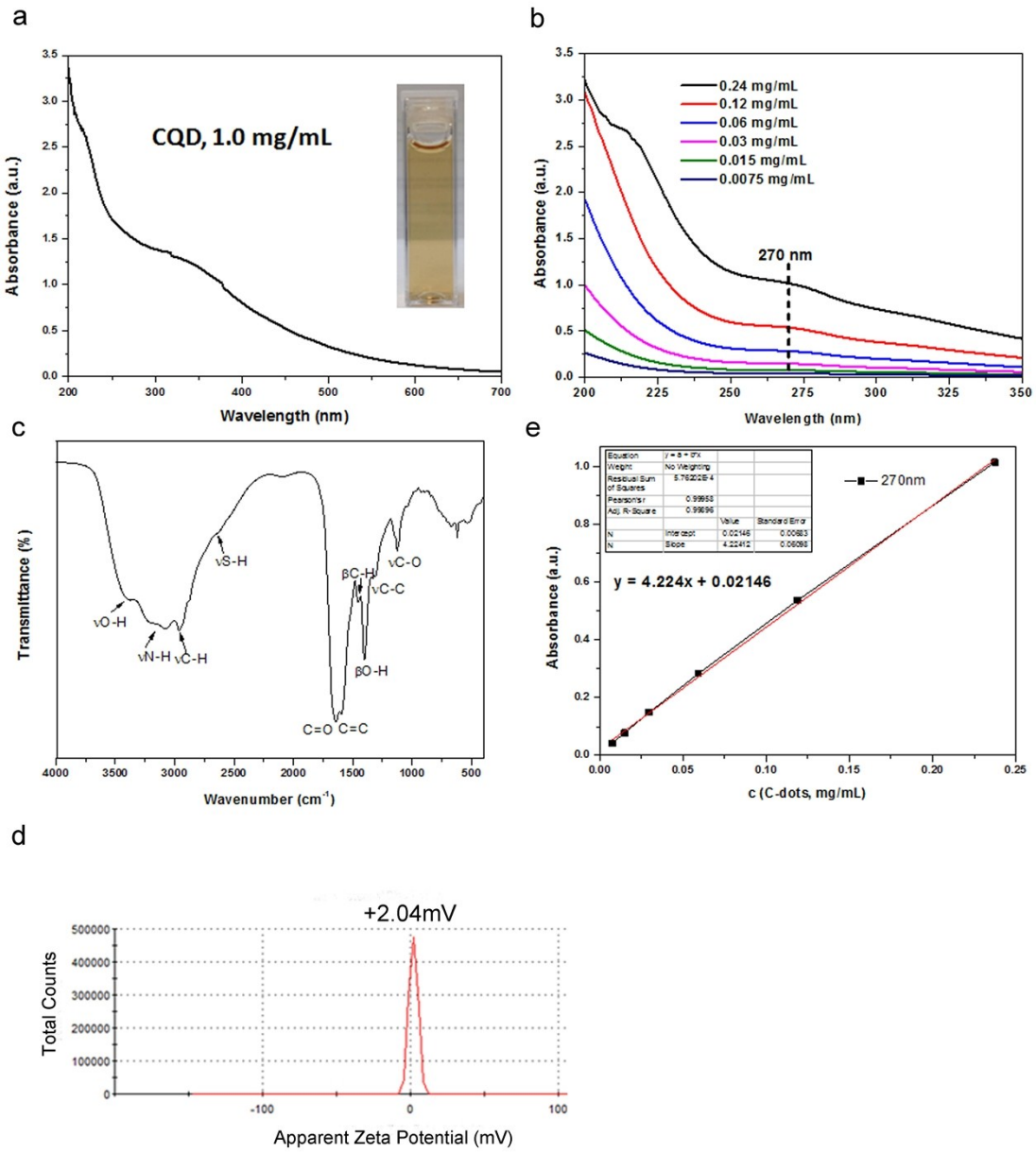
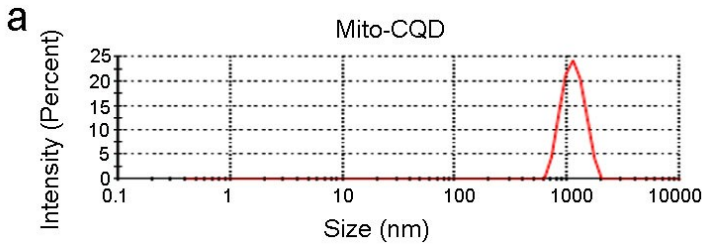
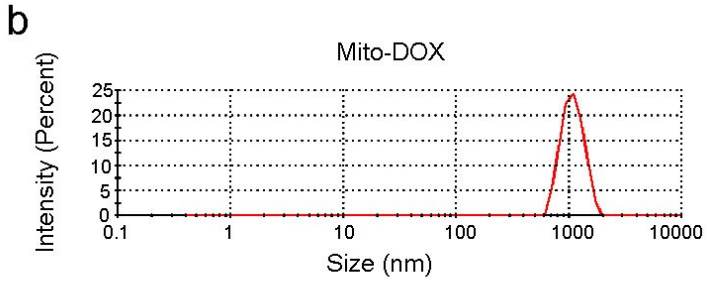


Fig S3. Characterizations of CQD.(a) UV–Vis absorption spectrum and the digital photo of CQDaqueous suspension (1.0 mg/mL).(b)FTIR spectrum of CQD.(c)Zeta potential of CQD.(d)UV–Vis absorption spectraof CQD suspension at different CQDconcentrations.(e) Corresponding standard curve of CQD suspension based onabsorption at 270 nm.





c

Zeta potential in PBS (mV)	
Mito-CQD	-18.6 ± 5.1
Mito-DOX	-19.2 ± 3.9

Fig S4. Characterizations of Mito-CQD and Mito-DOX. (a) Diameter distribution of Mio-CQD measure by dynamic light scattering(DLS). (b)Diameter distribution of Mio-DOX measure by dynamic light scattering(DLS). (c)Zeta potential of Mito-CQD and Mito-DOX.

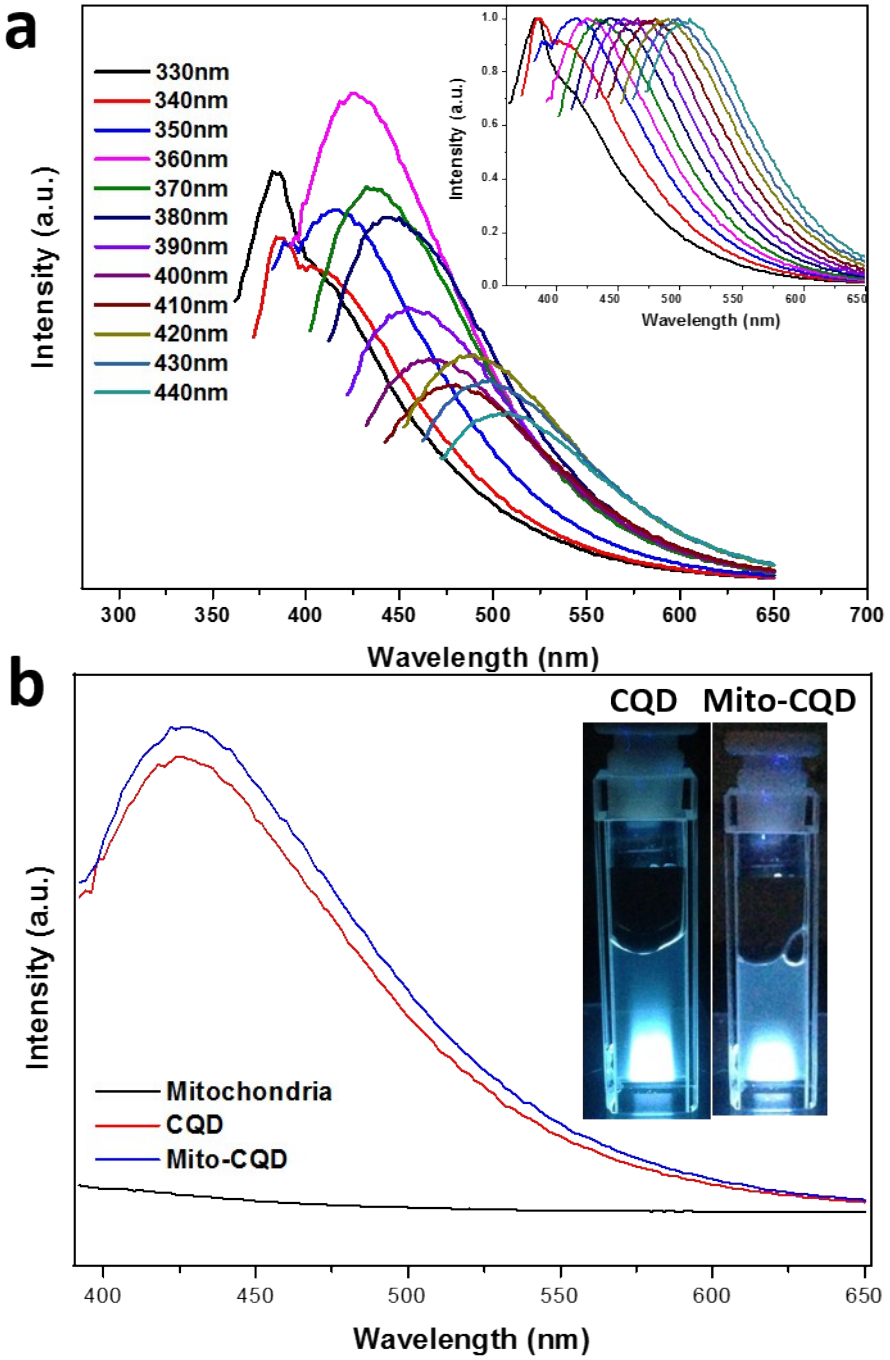


Fig S5. Optical characterization of CQD and Mito-CQD.(a)The photoluminescence spectra of the CQD excited at different excitation wavelengths, and the inset shows the corresponding normalized photoluminescencespectra.(b)The photoluminescence spectra of mitochondria, CQD, and Mito-CQD with excitation wavelength at 360 nm. Insets are the digital photos of CQD (left) and Mito-CQD (right) under excitation source of a microscope (DAPI channel).All the photoluminescence spectra were obtained using a microplate reader.

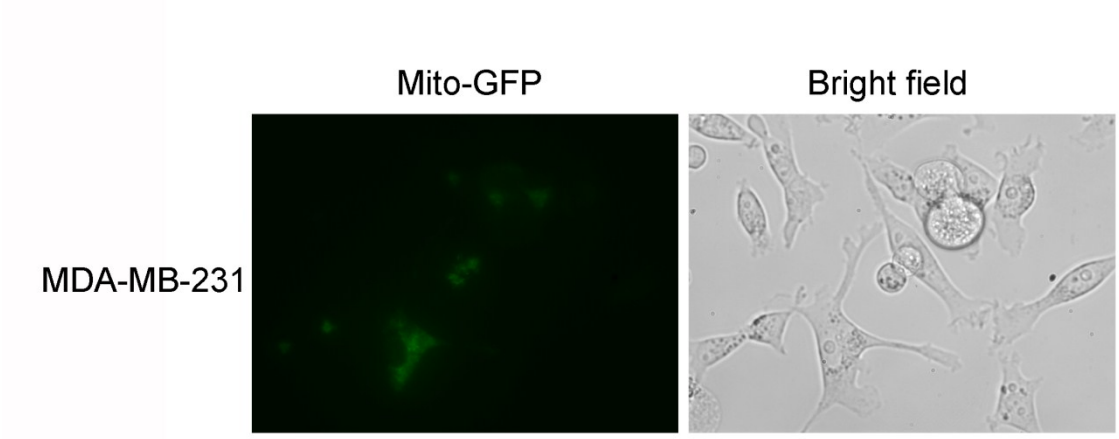
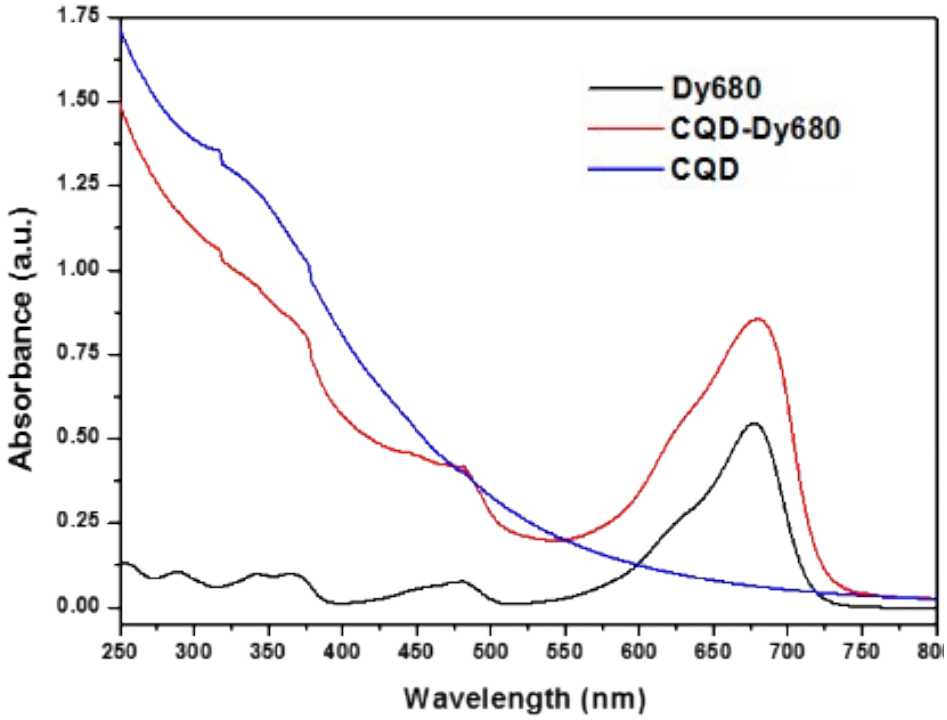


Fig S6. Confocal microscopy images of Mito-GFP.Toobtainthe Mito-GFP, MDA-MB-231 cells weretreated with CellLight Mitochondria-GFP kit (ThermoFisher Scientific,BacMam 2.0reagent) to quickly label the mitochondria with green fluorescent protein (GFP) for 48 hours.

a


Dy680
CQD-Dy680
CQD
Absorbance (a.u.)
Wavelength (nm)
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
250
300
350
400
450
500
550
600
650
700
750

b

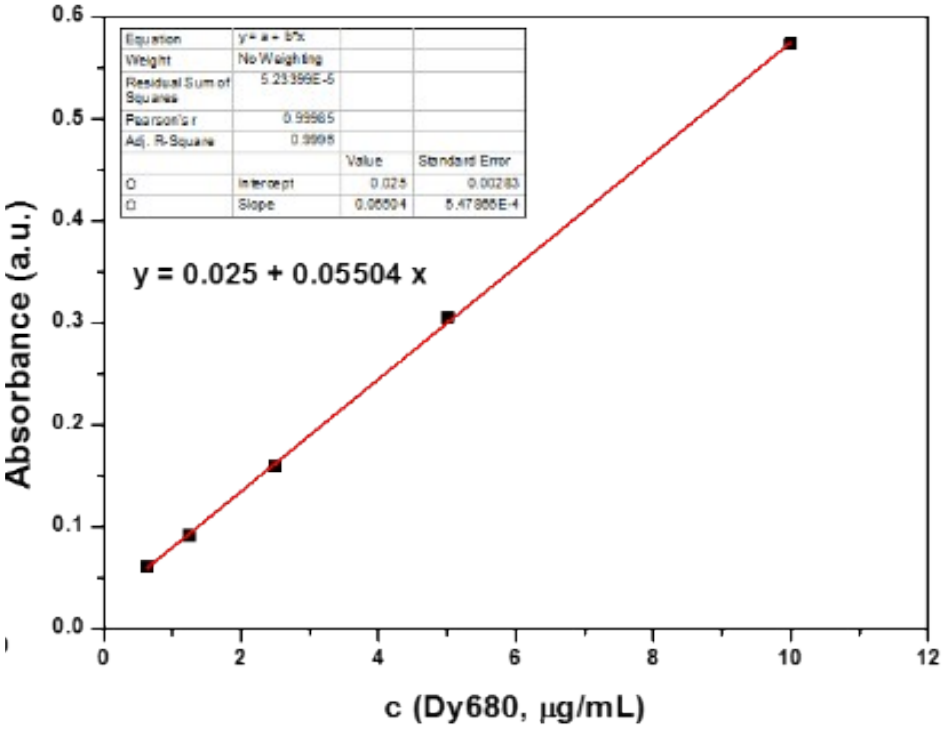
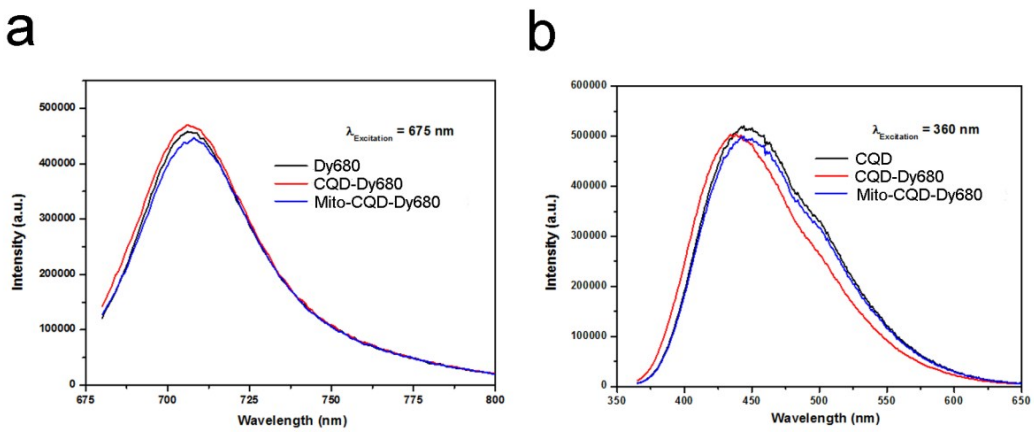

Equation y = a + b*x
Weight No Weighting
Residual Sum of Squares 5.23399E-5
Pearson's r 0.99985
Adj. R-Square 0.9995
Value Standard Error
Intercept 0.025 0.00283
Slope 0.05504 5.47865E-4
y = 0.025 + 0.05504 x
Absorbance (a.u.)
c (Dy680, μg/mL)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
2
4
6
8
10
12

Fig S7.UV-vis absorption of CQD and CQD-Dy680.(a)The UV-Vis absorption spectra of CQD(1mg/mL), Dy680 (10 μg/mL)andCQD-Dy680 (CQD 0.3 mg/mL, Dy680 15μg/mL). (b)UV-Vis standard absorption curveof Dy680at675 nm.(c)UV-Vis standard absorption curveof DOX at 482 nm.



FigS8. Photoluminescencespectra of CQD,Dy680 and CQD-Dy680.(a)The photoluminescence spectra of Dy680, CQD-Dy680 and Mito-CQD-Dy680 under 675 nm excitation.The concentration of Dy680 was 10 μg/mL.(b)The photoluminescence spectra of CQD, CQD-Dy680 and Mito-CQD-Dy680under 360 nm excitation.The concentration of CQDwas 200 μg/mL.All the photoluminescence spectra were obtained using a Horiba FluoroMax 4 spectrometer.

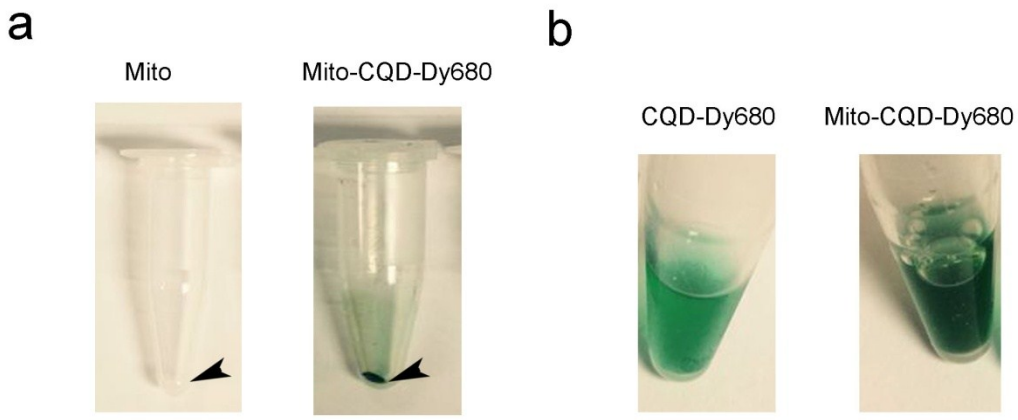
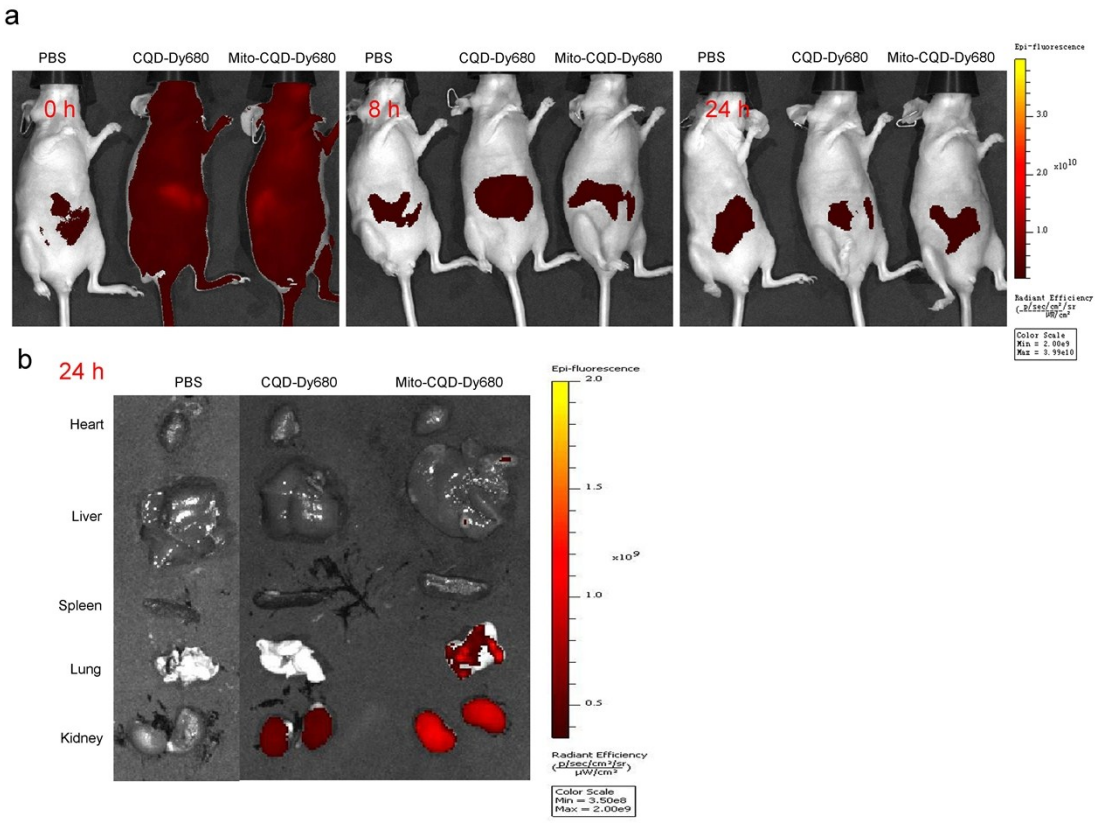


Fig S9. Photos of Mito, CQD-Dy680 and Mito-CQD-Dy680.(a) Pellet of isolated mitochondria (left) and Mito-CQD-Dy680 (right). (b)CQD-Dy680 (left) and Mito-CQD-Dy680 (Right) suspendedin PBS.



FigS10. Biodistribution of CQD-Dy680 and Mito-CQD-Dy680 after intravenousinjection. (a)NIR fluorescence images of mice acquired at 0, 8 and 24 h after intravenousinjection: PBS, CQD-Dy680 and Mito-CQD-Dy680. (b)*Ex vivo* imaging of biodistribution of CQD-Dy680 and Mito-CQD-Dy680. Afterinjection of CQD-Dy680 and Mito-CQD-Dy680, the major organs and tissues were harvested from SCID mice at the indicated time points, andNIR imaging were acquired using a Lumina III LTE imaging system. 24 hours postinjection, heart, liver, spleen, lung,kidney.

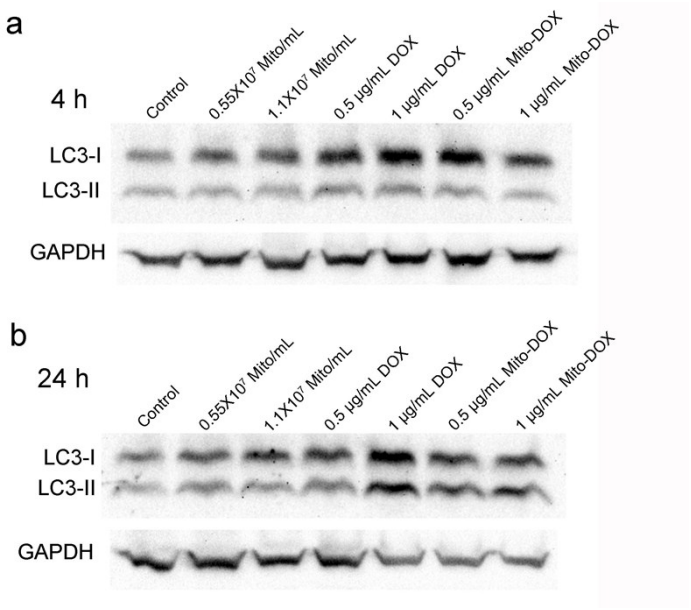


Fig S11. Western blot of LC3-I/II after DOX and Mito-DOX treatment.The cells were treated with different concentrations of Mito, DOX and Mito-DOX for (a)4 hours and (b)24 hours, and then blotted for LC3-I/II. PBS treated cells were served as the control group. GAPDH was inner control in western blot. (n=3).