Biodistribution, Excretion, and Toxicity of Polyethyleneimine Modified NaYF₄:Yb,Er Upconversion Nanoparticles in Mice via Different Administration Routes

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**Figure S1.** EDX spectrum of PEI@UCNPs. The Si element comes from the silicon substrate.
Figure S2. (a) Stability tests of PEI@UCNPs in PBS, FBS, DMEM, and water dispersions (concentration: 500 µg mL⁻¹). (b) XRD patterns of PEI@UCNPs incubated with PBS, FBS, DMEM, and water solutions for 24 h, respectively.
Figure S3. PEI@UCNPs synthesized by adding different amount of water: (a,b) 2 mL of water, and (c,d) 3 mL of water.
Figure S4. PEI@UCNPs synthesized by different solvothermal reaction time: (a) 6, (b) 12, (c) 24, and (d) 48 h.
**Figure S5.** PEI@UCNPs synthesized by adding different amount of precursors: (a) 0.4 mmol of Er\(^{3+}\), (b) 0.1 mmol of Yb\(^{3+}\), and (c) 0.4 mmol of Y\(^{3+}\).
Figure S6. (a) TGA plot of PEI@UCNPs. Inset in (a) shows the magnified TGA plot of PEI@UCNPs. (b) Relative cell viability of BEL-7402 cells after incubation with different concentrations of PEI for 24 h.
Figure S7. Cell imaging under (a) bright field and (b) 980 nm laser irradiation after being incubated with PEI@UCNPs (10 μg mL⁻¹) for 24 h.
Figure S8. Changes in body weight of mice via i.p. and i.v. injected with PEI@UCNPs within 30 days. Error bars represent standard deviation calculated from three mice.
Figure S9. Organ biodistribution of $^{64}$Cu-NOTA-PEI@UCNPs at 24 h after i.v. injection, determined by γ-counter (n=3). (% ID/g organ)