Supplementary Material (ESI) for *New Journal chemistry*

Developing Electropositive Citric Acid-Polyethylenimine Carbon Quantum Dot for Labeling and Tracing Mesenchymal Stem Cells *in vitro* and *in vivo*

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Table. S1 The parameters for calculating the quantum yield of CA-PEI CQD.

Sample	Integrated emission intensity（I）	Optical density at 320 nm（A）	Refractive index of the solvent (n)	Quantum yield （%）
Quinine sulfate	505524.292	0.048	1.33	55.7%
CA-PEI	90454.111	0.048	1.33	9.966%

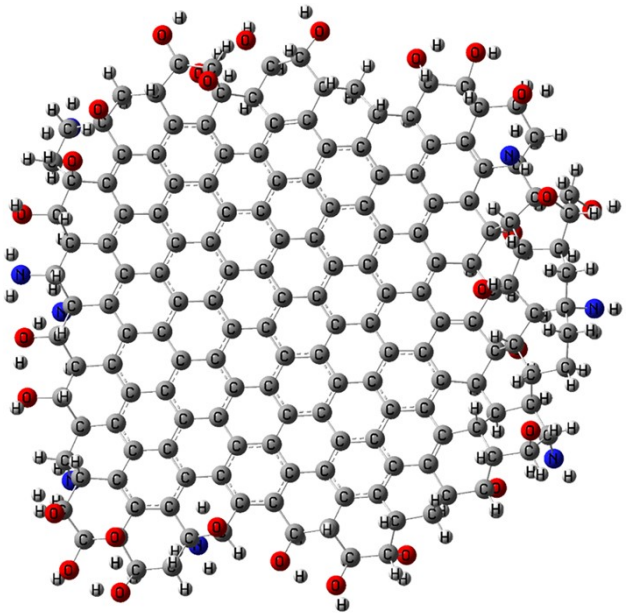

Fig. S1. The optimized CA-PEI CQD model, which contains 170 carbon atoms, 8 nitrogen atoms, 28 oxygen atoms and the edges of CA-PEI CQD model were saturated with hydrogen atoms.

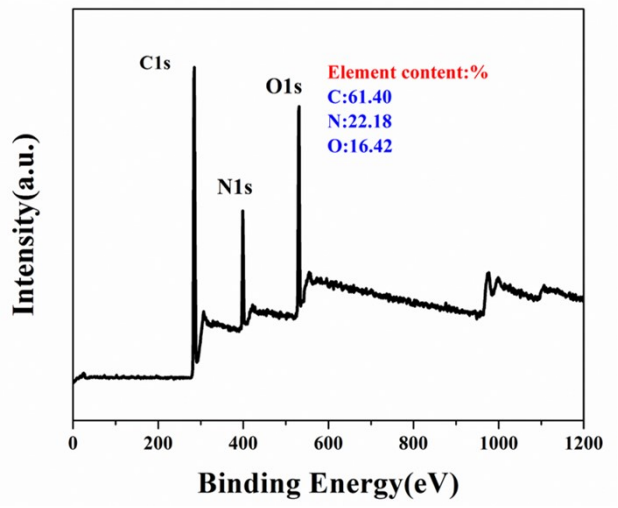

Fig. S2. The full XPS spectra of CA-PEI CQD.

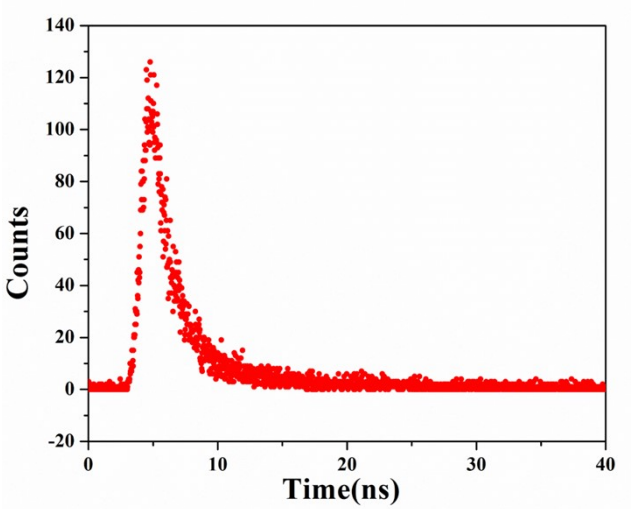

Fig. S3. The fluorescence lifetime decay of CA-PEI CQD

Fig. S4. The image of the deionized water (left) and the image of the deionized water under UV light irradiation (360 nm).

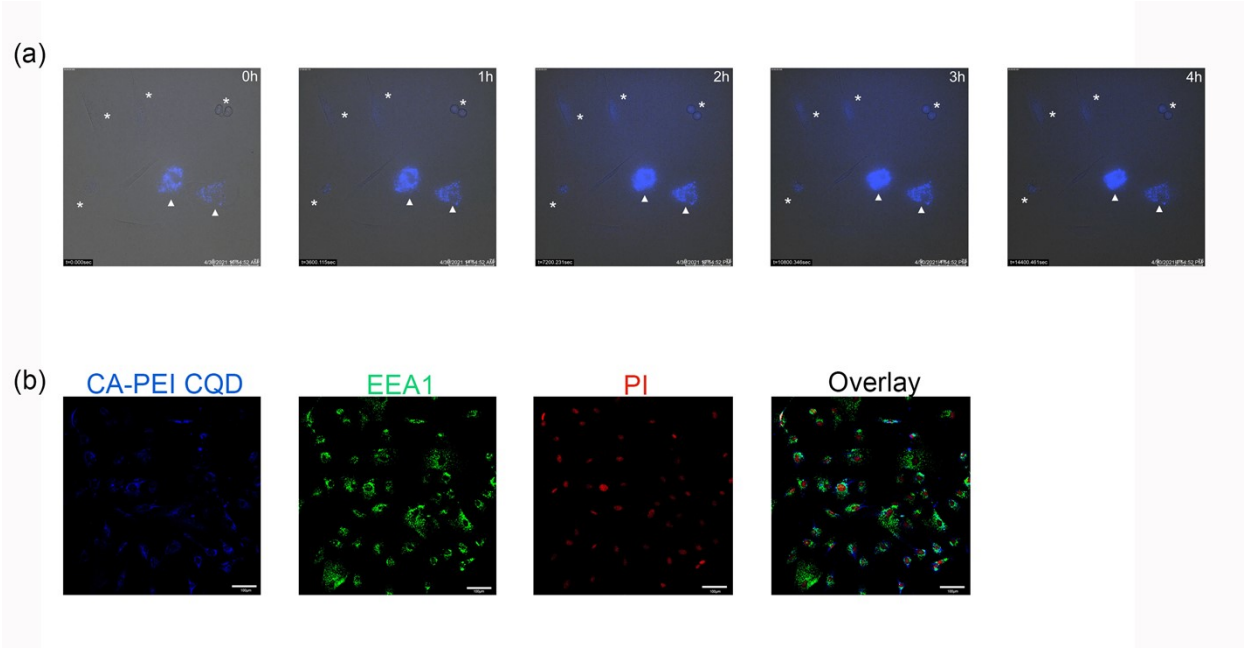

Fig S5. Time-lapse photography shows an active absorption process of CQD from the sender MSCs (triangles) pre-labeled with CA-PEI CQD to unlabeled receiver MSCs (stars). Magnification: x200 (a). Expression of EEA1 (green, early endosome marker) detected by immunofluorescence in the MSCs incubated with 200 μg/ml CA-PEI CQD (blue) for 8 hours (b). Nuclei were stained by propidium iodide (PI). Scale bar: 100 μm.