Supplementary Information

Three-photon imaging using defect-induced photoluminescence in biocompatible ZnO nanoparticles

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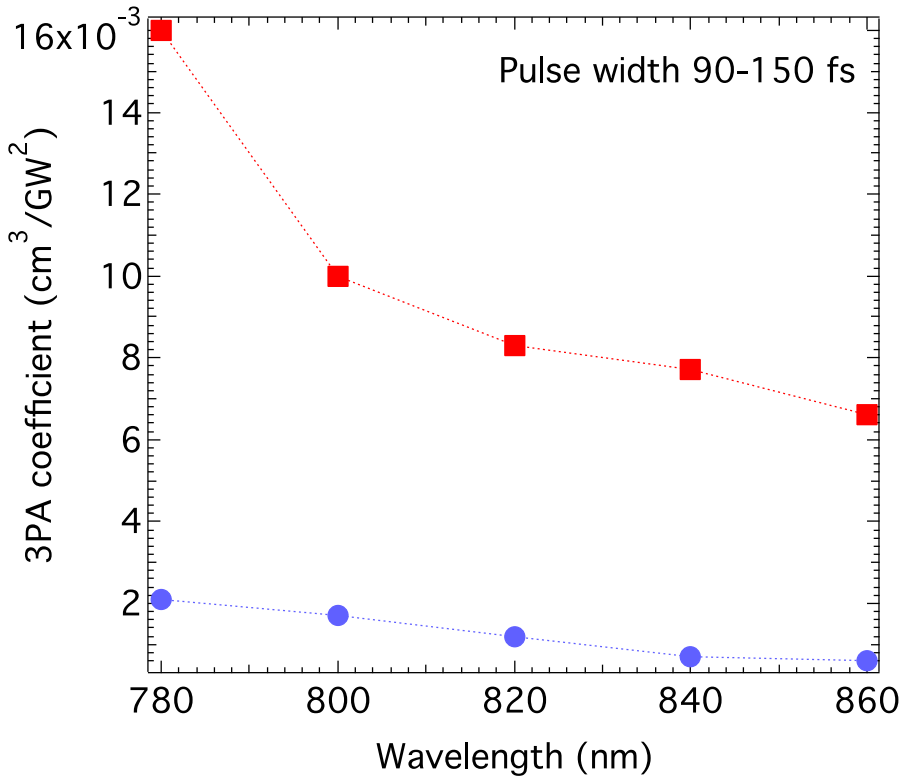

Fig. S1 Three-photon absorption coefficients for ZnO (red squares) and ZnS (blue dots) NPs measured using ultra-fast fs Z-scan measurements (J. He et al., OPTICS EXPRESS vol. 13, 23, 9235).

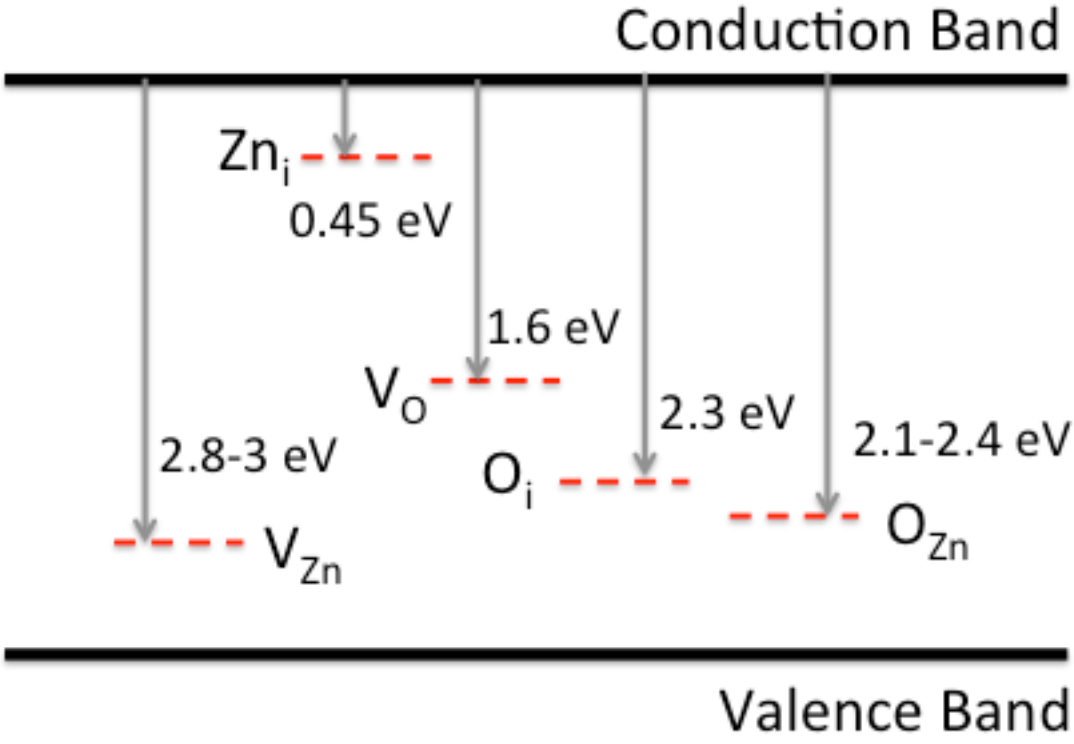

Fig. S2 Defect-induced electronic states within the band gap of ZnO NPs (B. Lin *et al.* J. Electrochem. Soc. 2001 vol. 148 no. 3 G110-G113)

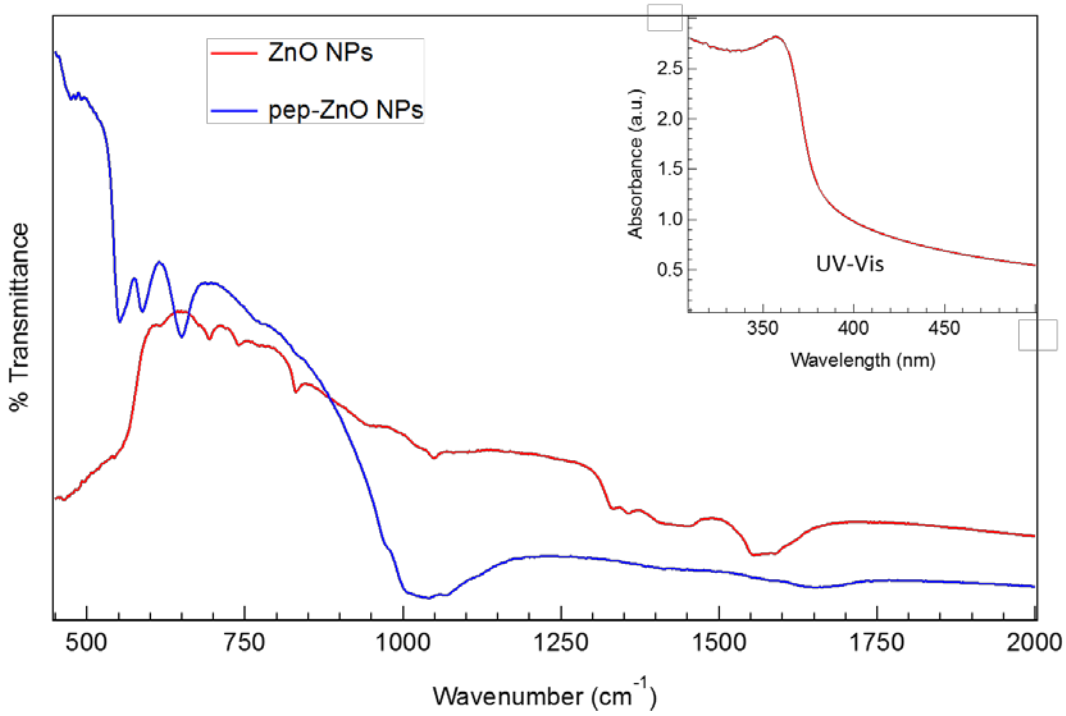

Fig. S3 FTIR spectra of pep-ZnO NPs show stronger signatures of C-O stretch (~1000 cm-1), carboxyl (~1600 cm-1) unlike pristine ZnO. Inset shows UV-Vis spectrum of bare ZnO NPs showing absorbance peak around 360 nm corresponding to the band edge ~3.4 eV.

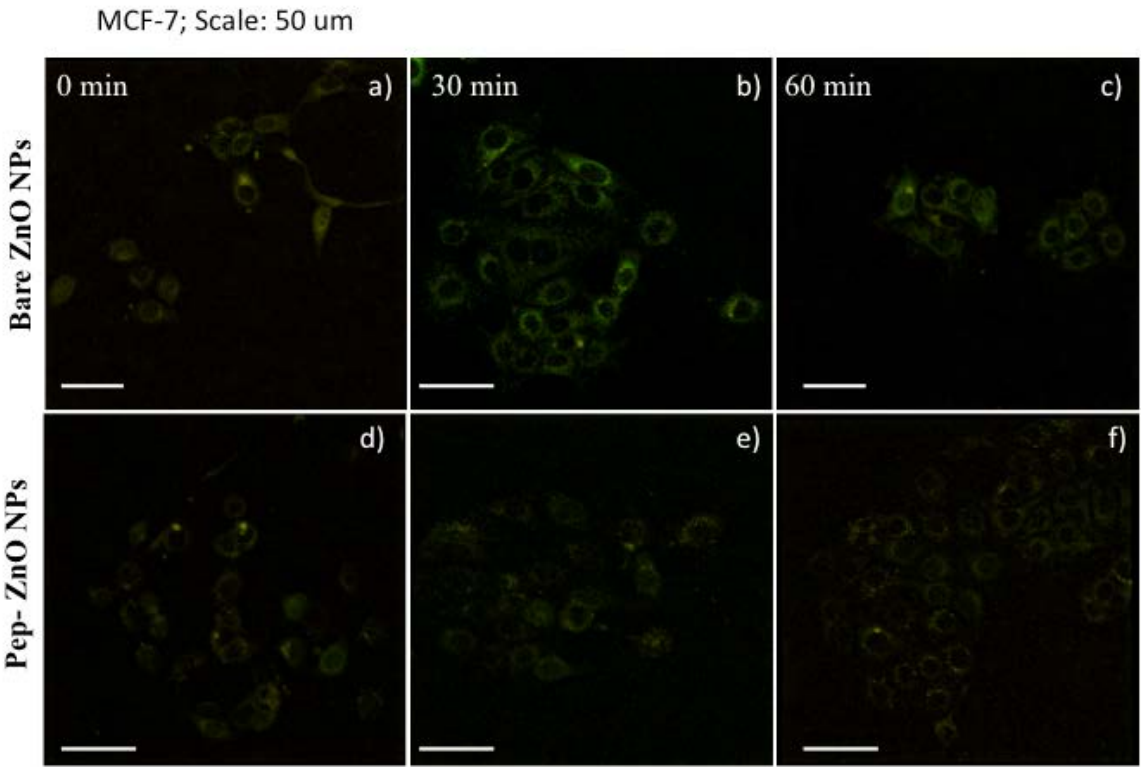

Fig. S4 Three-photon images for integrin-negative MCF-7 cells at different incubation times with (a-c) bare ZnO NPs and (d-f) pep-ZnO NPs showed no difference in uptake before and after functionalization due to the absence of integrin receptors.

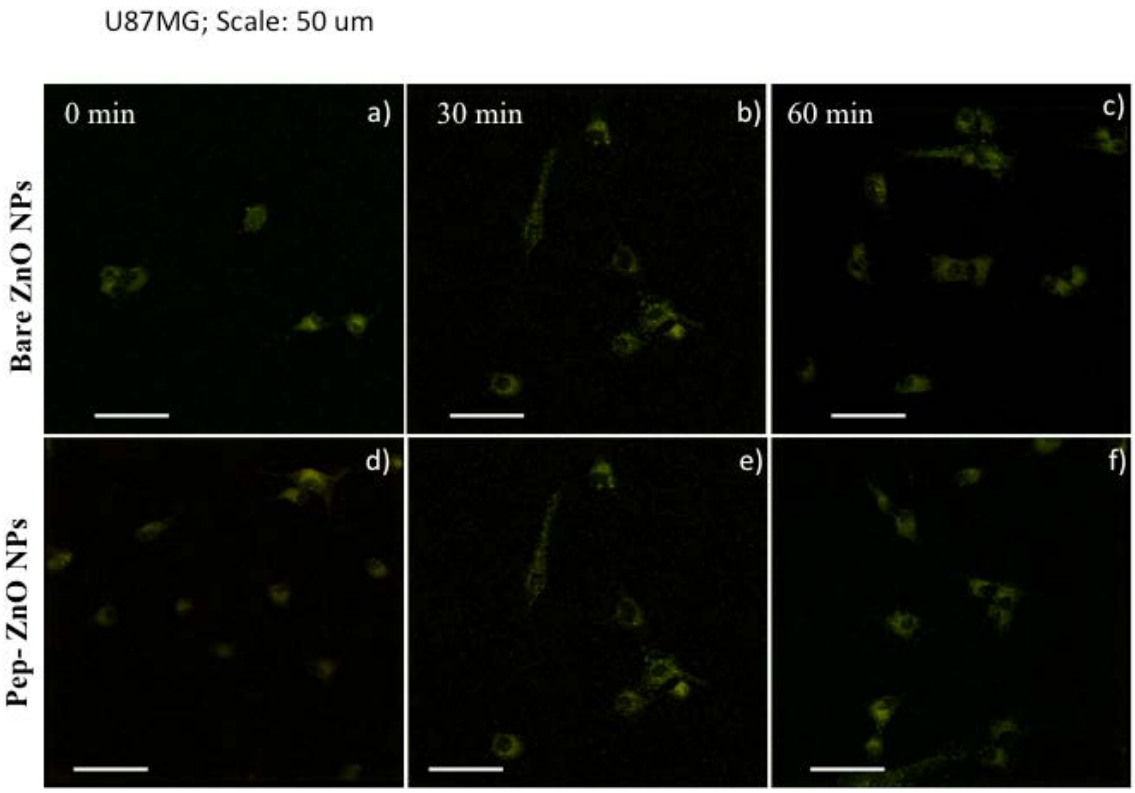

Fig. S5 Three-photon images for U87MG cells at different incubation times with (a-c) bare ZnO NPs and (d-f) pep-ZnO NPs showed increased uptake after functionalization at 60 mins due to selective binding of RGD pep-ZnO NPs with integrin receptors.

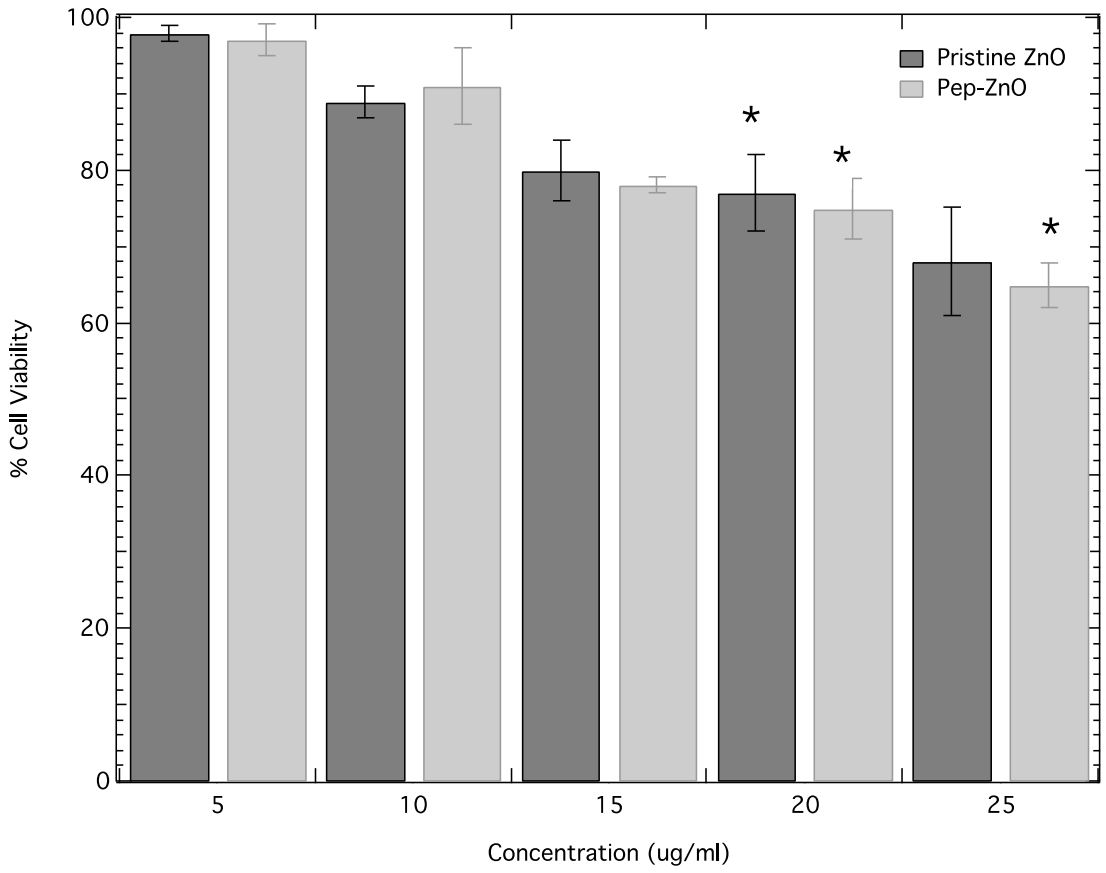

Fig. S6 RAEC Cell viability analyzed after 24 hrs with MTS assay kit showed no significant change in number of viable cells with ZnO NPs and pep-ZnO NPs up to 20 ug/ml concentrations that are relevant to imaging experiments performed in this study.

Multiphoton Imaging of ZnO NPs in cells – Imaging Parameters
Objective Used: Leica HC PL APO CS2 40x/1.10 water
Frame Average: 4
Line Average: 4
Laser Settings
Wavelength: 975 nm (Intensity – 14.3%; Gain – 42.9%; Offset – 33.13%) Detector 1: HyD6 APD1; HyD standard mode; Gain – 123.7; Pseudocolor = green Detector 2: HyD7 APD2; HyD standard mode; Gain – 123.7; Pseudocolor = red
Argon Laser Settings: 488 nm (Intensity – 22.517%) PMT Trans Detector: Gain – 254; Offset – 0 Laser peak power for all images: 905-911 W Pulse duration: 75-100 fs Pulse repetition rate: 80 MHz Average laser power for all images: 5.1-5.5 mW Average laser power at the sample: 0.5-1 mW

Table S1 Laser settings and powers used for obtaining three-photon images.