Supplementary Material (ESI) for Nanoscale
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Enhanced Cell Uptake via Non-covalent Decollation of Single-walled Carbon Nanotube-DNA Hybrid with Polyethylene Glycol-grafted Poly(L-lysine) Labeled with an Alexa-dye and its Efficient Uptake in a Cancer Cell

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Determination of molar absorption coefficient of the DNA at 280 nm: Based on the molar absorption coefficient of $(dT)_{20}$ at 260 nm (1.68×10^5 M^{-1} cm^{-1}),[1] an aqueous $(dT)_{20}$ solution was diluted to1,000 nM using a tris-EDTA solution. By further diluting the solution, five specifically different solutions of different concentrations were prepared. By absorption measurements of the solutions, the molar absorption coefficient of the DNA, here $(dT)_{20}$, at 280 nm was determined to be 1.22×10^5 M^{-1} cm^{-1} (Fig. S2).

Estimation of molar ratio between SWNT and DNA: To evaluate the DNA amount in the SWNT/DNA solution, we prepared the reference SWNT solution dispersed in sodium dodecyl sulfonate (SDS) so that we could subtract the absorption of the SWNTs. The superimposed spectra of the SWNT/DNA with the SWNTs in SDS revealed the amount of DNA in SWNT/DNA as much as

1.9 μM determined from the absorption difference (Fig. S1), in which the molar absorption coefficient of the DNA at 280 nm (1.22×10^5 M^{-1} cm^{-1}) was used.

Shinohara et al. reported the absorption coefficient of the SWNT/DNA at 280 nm per 1 nm ($2.9 \pm 1.1) \times 10^4$ $M^{-1}nm^{-1}cm^{-1}$).[2] We carefully measured the lengths of our SWNT/DNA hybrid in more than 50 tubes from the AFM images and determined that the SWNT/DNA possess an average length of 279 nm, which allowed us to calculate the coefficient to be 8.1 μM^{-1} cm^{-1} in our system. The concentration of the SWNTs in the SWNT/DNA solution was determined to 0.43 μM based on the absorption of the SWNT/DNA at 280 nm, and finally, the hybrid ratio between the SWNT to DNA was determined to be 4.5 (=1.9/0.43).

References

[1] http://www.hssnet.co.jp/2/2_1_1_5.html#3

[2] S. Kuwahara, T. Sugai, H. Shinohara, *Phys. Chem. Chem. Phys.* 2009, *11*, 1091.

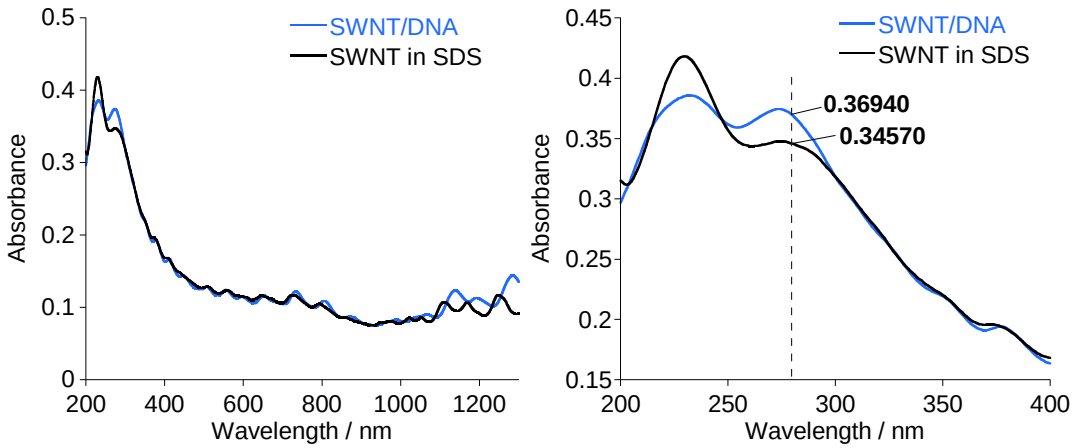

Fig. S1 (left) Absorption spectra of aqueous solutions of the SWNT/DNA after filtration (blue line) and the SWNTs dispersed in an aqueous SDS solution (black line). The spectra were superimposed based on the absorbance at 300 nm. (right) Magnification of the left spectra in the wavelength range of 200 – 400 nm.

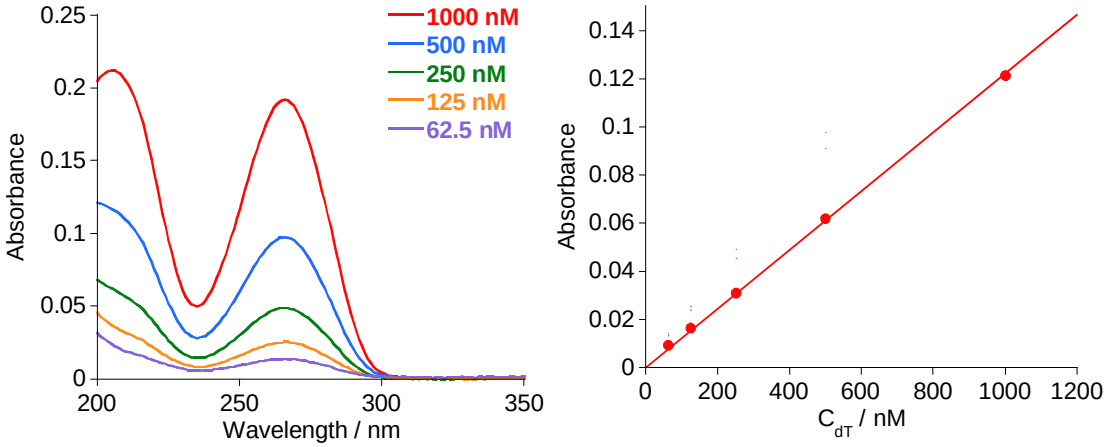

Fig. S2 (left) Absorption spectra of the DNA in five different concentrations of tris-EDTA. (right) Plot of the absorption at 280 nm.

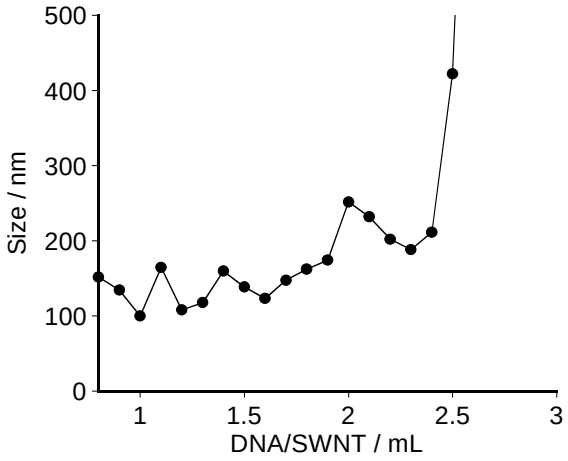

Fig. S3 Plot of the size determined by DLS measurements upon the addition of the SWNT/DNA to an Alexa-PLL-*g*-PEG aqueous solution.

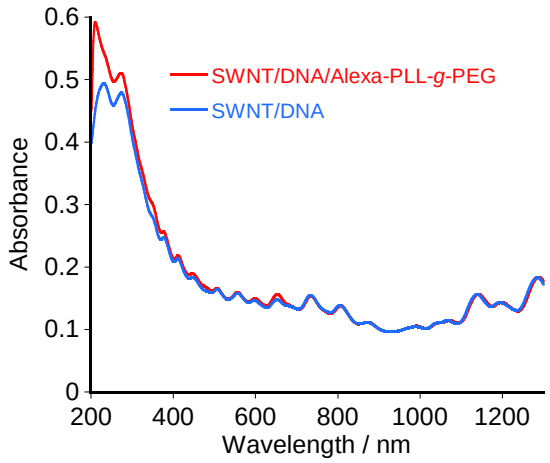

Fig. S4 Absorption spectra of an SWNT/DNA aqueous solution (blue line) and SWNT/DNA/Alexa-PLL-*g*-PEG (red line) in the wavelength range of 200 – 1300 nm. Optical cell length: 1 cm.

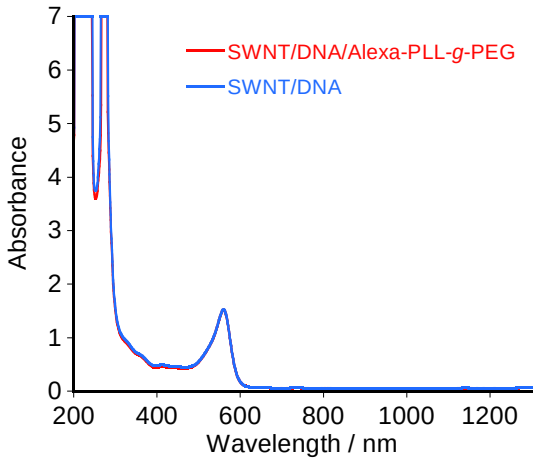

Fig. S5 Absorption spectra of SWNT/DNA (blue line) and SWNT/DNA/Alexa-PLL-*g*-PEG in a D-MEM solution (red line) in the wavelength range of 200–1300 nm. Optical cell length: 1 cm.

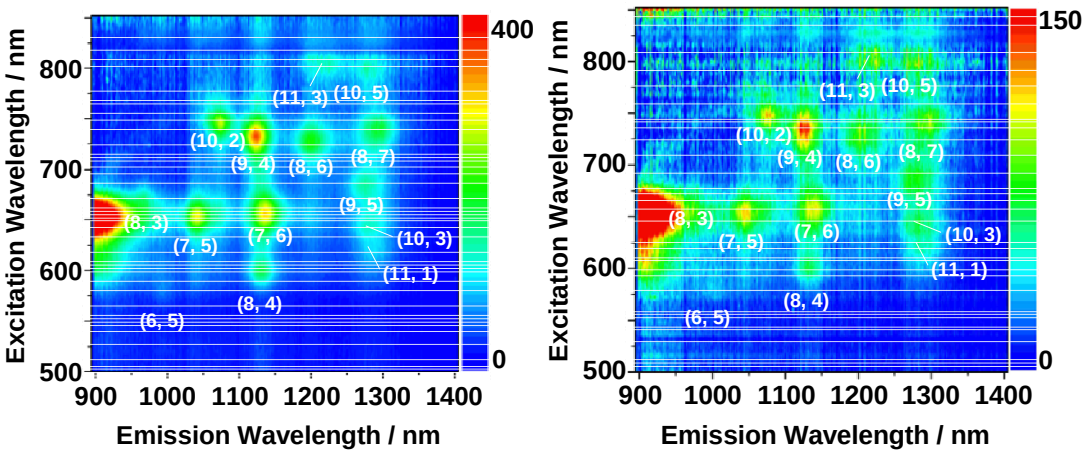

Fig. S6 NIR PL mappings of the SWNT/DNA/Alexa-PLL-*g*-PEG aqueous solutions added to the cell culture after (left) 1 min and (right) 2 weeks.