Supporting Information

Cytoprotective Effect of Graphene Oxide for Mammalian Cells against Internalization of Exogenous Materials

Mi-Hee Kim, Hee-Kyung Na, Jieon Lee, Young-Kwan Kim, Hongje Jang, Kyung Eun Lee, Hyerim Park, Won Do Heo, Hyesung Jeon, Insung S. Choi, Younghoon Lee and Dal-Hee Min*

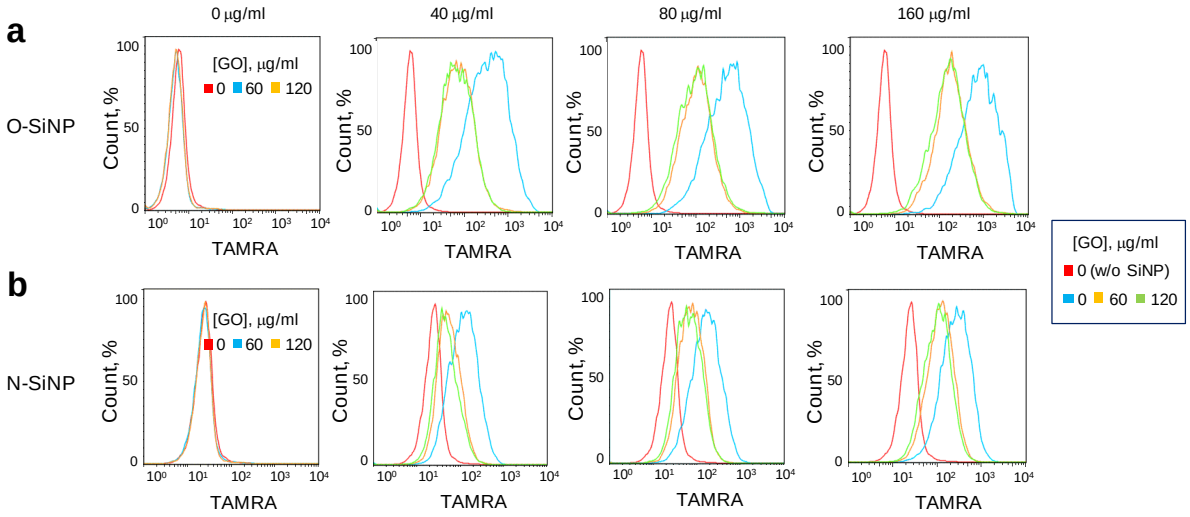

Figure S1. Protective effect of GO from the cellular uptake of SiNPs. Histograms of flow cytometry of **a,** O-SiNP and **b,** N-SiNP treated HeLa cells with or without pre-treatment of GO. These data support efficient protective effect of GO from SiNPs internalization regardless of the surface charges.

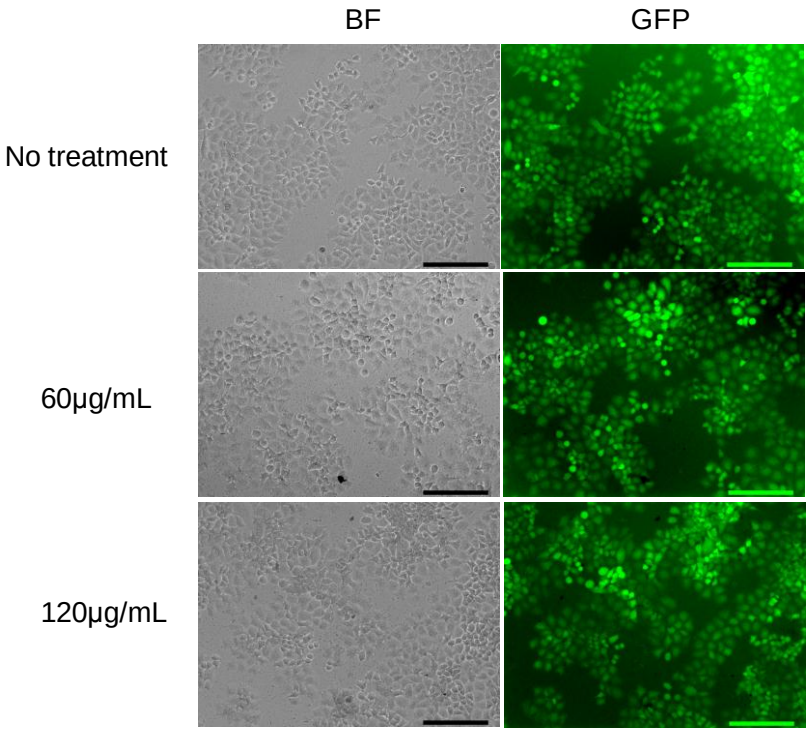

Figure S2. Images of cells after treatment of GO with varying concentrations. Green fluorescence of GFP expressing HeLa cells was hardly affected by the treatment of GO to the cells.

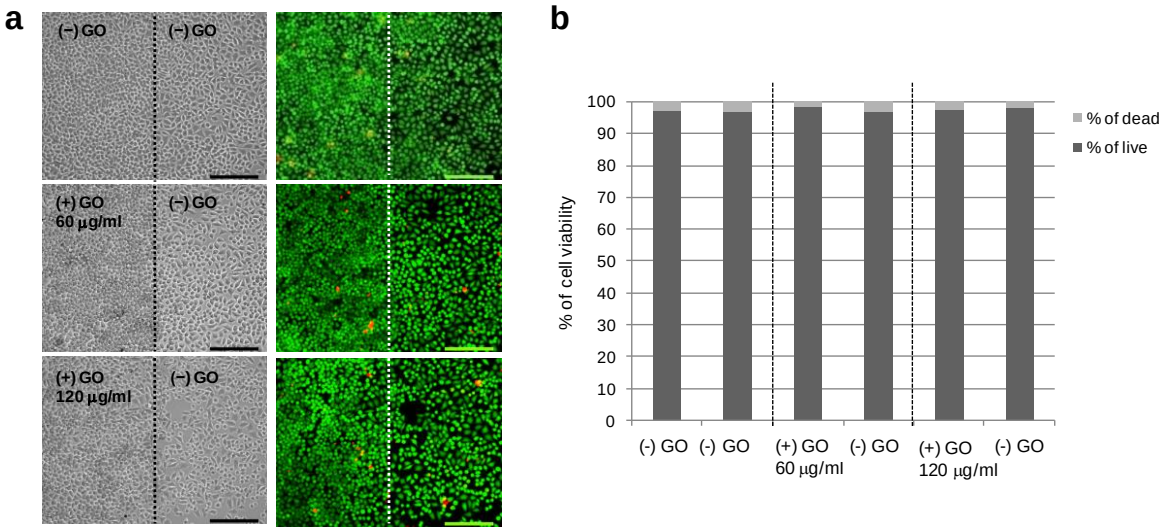

Figure S3. Cell viability in a half-half system. **a,** Live/dead staining of cells in a half-half system. **b,** Quantification of live and dead cells based on the data in **a**. The number of live and dead cells were counted and analyzed by using NIH ImageJ. Scale bar is 200 μm.

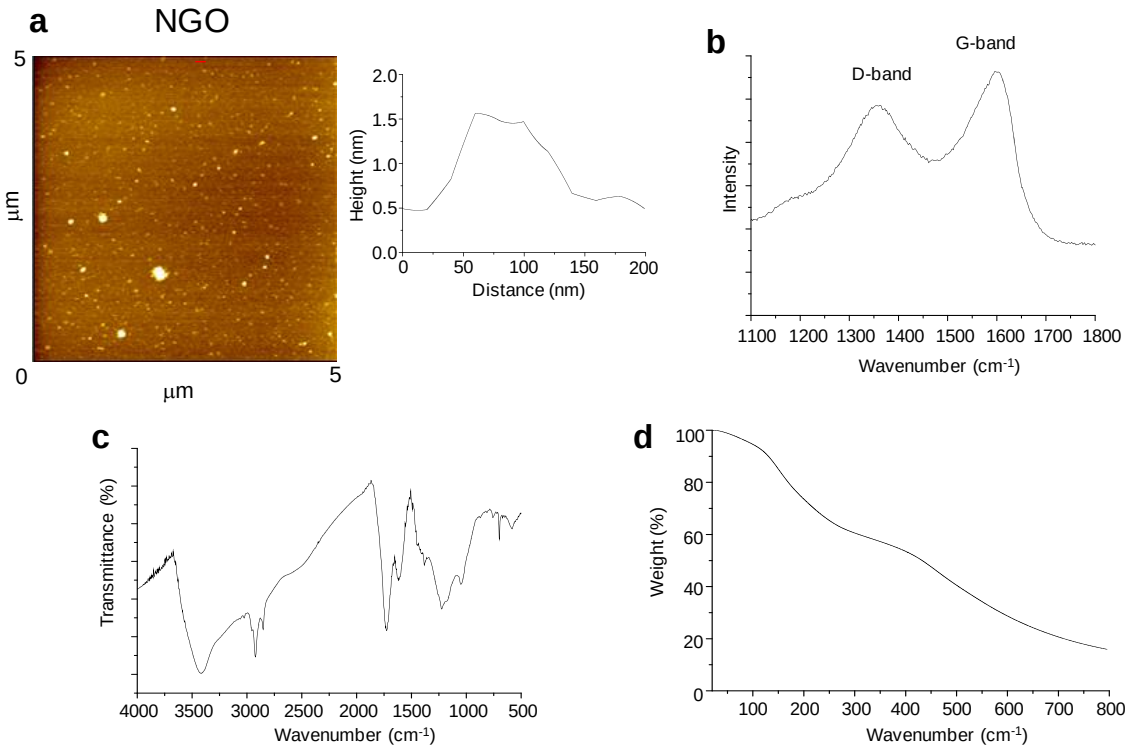

Figure S4. Characterization of NGO. **a,** AFM image and line profile of NGO. The sheet width of NGO was less than 100 nm and height of NGO was ~0.98 nm. Sheet size of NGO was found much smaller than that of GO (Sheet size of GO was 0~3.5 μm. see Figure S1.) **b,** Raman spectrum of NGO. Strong D-band absorption around 1350cm^{-1} appeared. **c,** IR spectrum of NGO. Several peaks of oxygen-containing functional groups were observed at 1716 cm^{-1} (C=O stretching) and 1079 cm^{-1} (C-O stretching). **d.** Thermogravimetric analysis (TGA) of NGO under a nitrogen gas atmosphere.

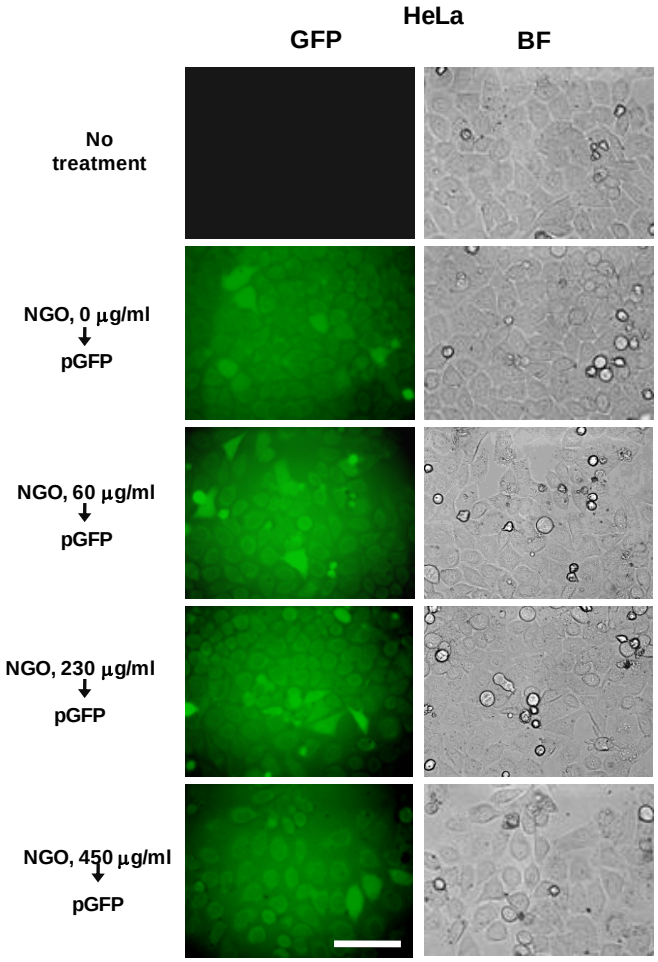

Figure S5. pGFP transfection was performed in HeLa cells after the treatment of NGO in place of GO. NGO did not show significant protection effect in HeLa cells against pGFP transfection within a range of tested concentrations.

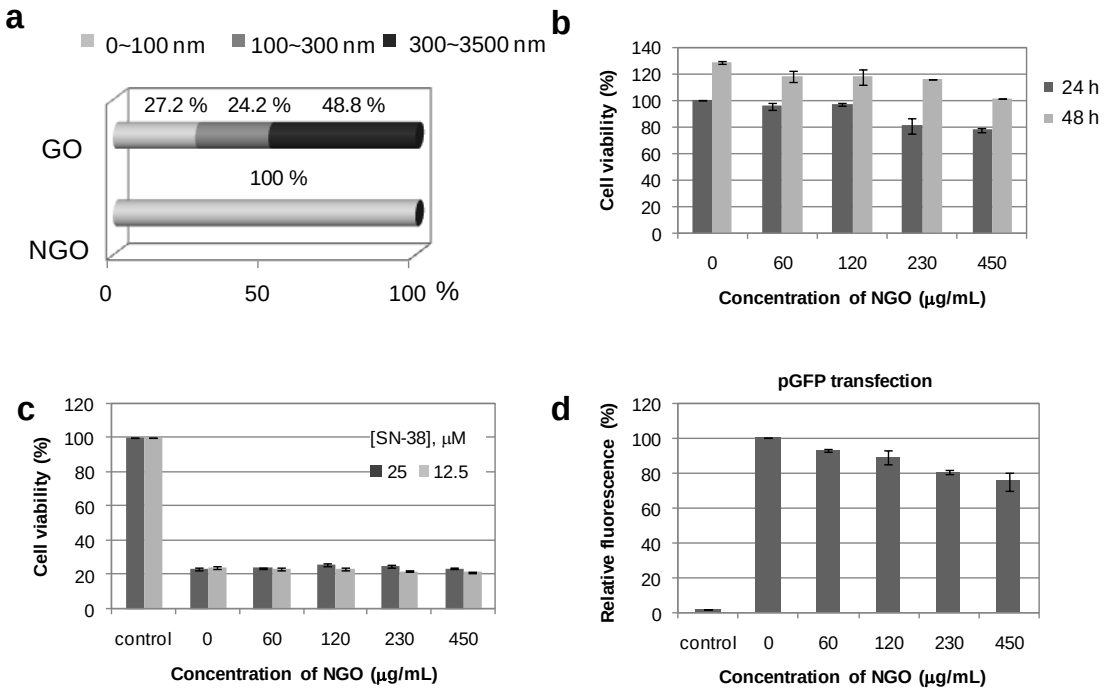

Figure S6. NGO was used in place of GO to know whether the protection effect is dependent on sheet sizes of graphene derivatives. **a,** Comparison on sheet size distribution of GO and NGO. More than 70 % of GO has sheet sizes larger than 100 nm whereas there is no sheet larger than 100 nm in NGO sample. **b,** Viability of HeLa cells treated with NGO was determined by MTT assay. Slight reduction of cell viability was observed at the NGO concentration of higher than 230 μg/ml. **c.** HeLa cells were treated with NGO followed by SN-38 to investigate the effect of NGO on SN-38 induced cell death. No protection effect was observed with the pretreatment of NGO up to 450 μg/ml **d.** NGO did not effectively protected HeLa cells from plasmid DNA transfection. All the results suggest that size of GO might be one of the important factors to achieve good protection effect.

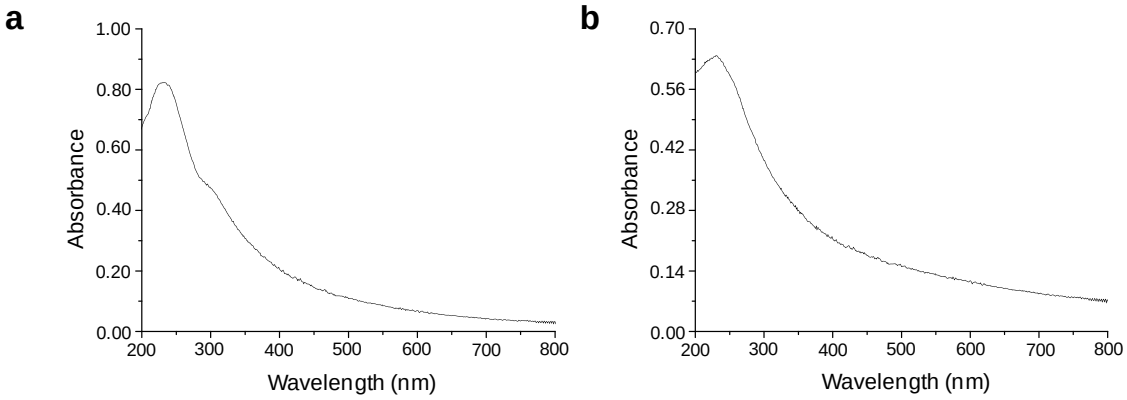

Figure S7. UV-vis spectra of GO (a) and nGO (b).