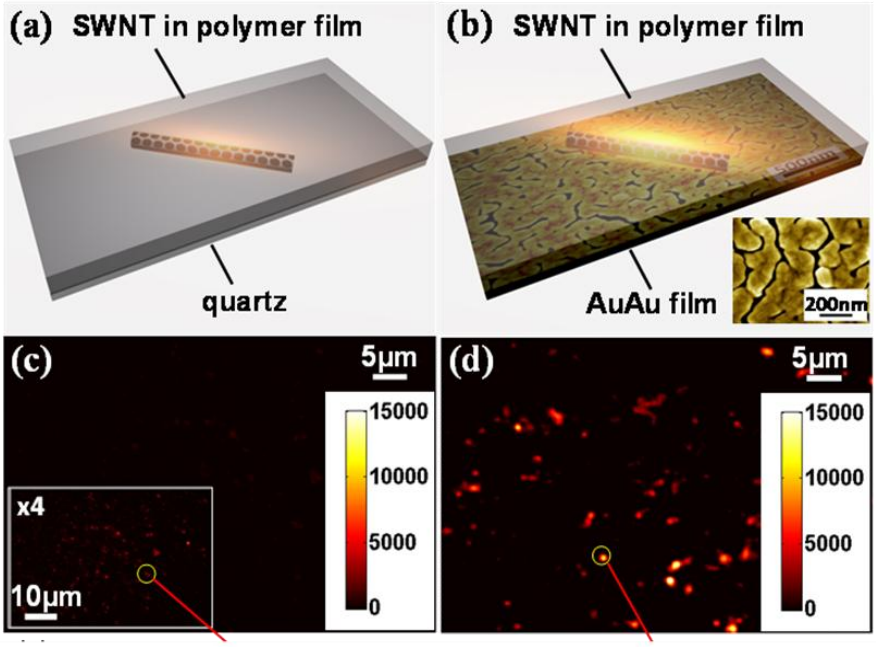
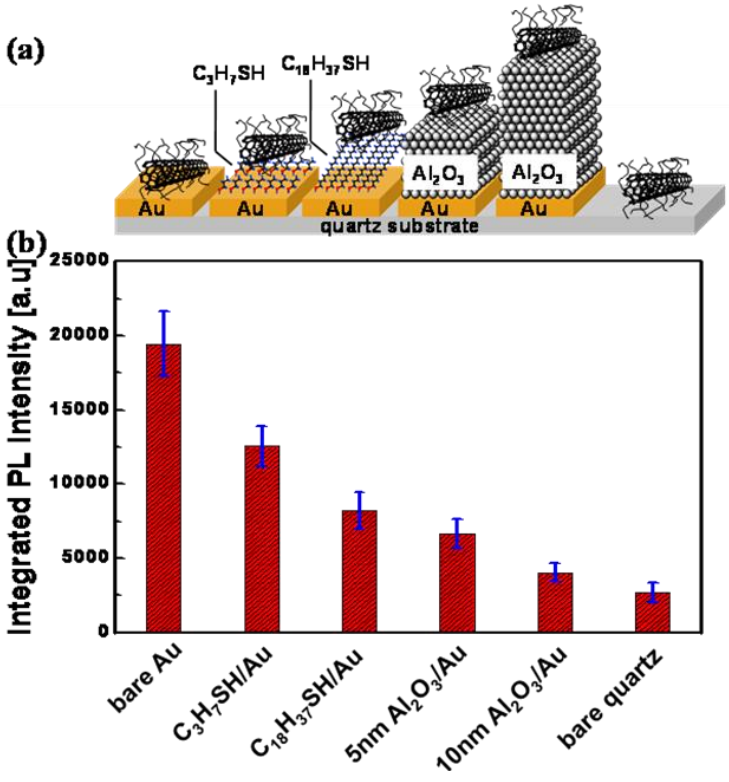
Fluorescence Enhancement in the NIR on Gold

(up to 14 X)



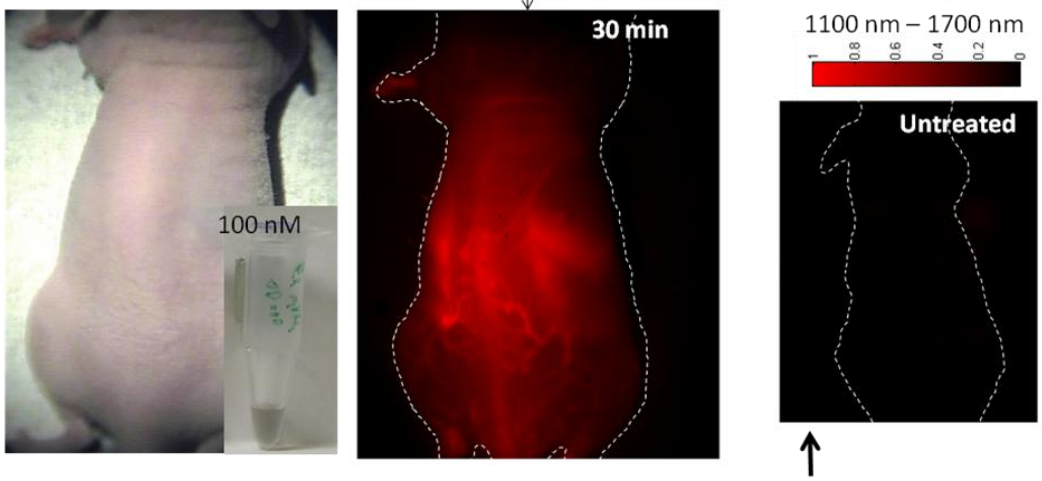
Guosong Hong, Scott Tabakman, JACS, 2010

Fluorescence Enhancement vs. Nanotube-Metal Distance



Nanotube Photoluminescence Imaging of Mice

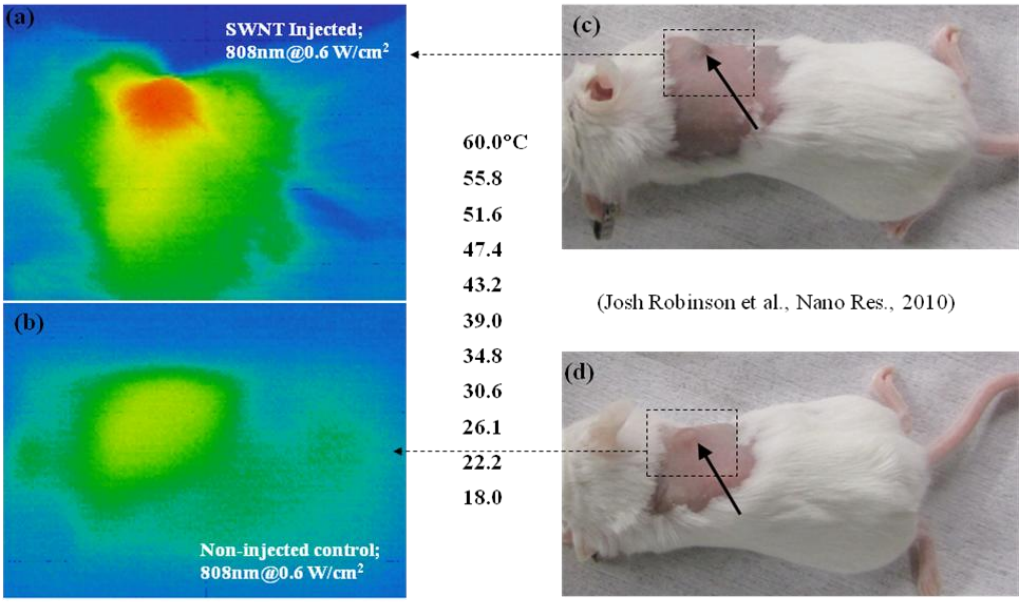
The first mice imaging using 1-1.4 μm emission



Welsher, K. et al. *Nature Nanotechnology*, 2009

Little or no autofluorescence seen!

In-vivo NIR Laser Photothermal Therapy



(Josh Robinson et al., Nano Res., 2010)

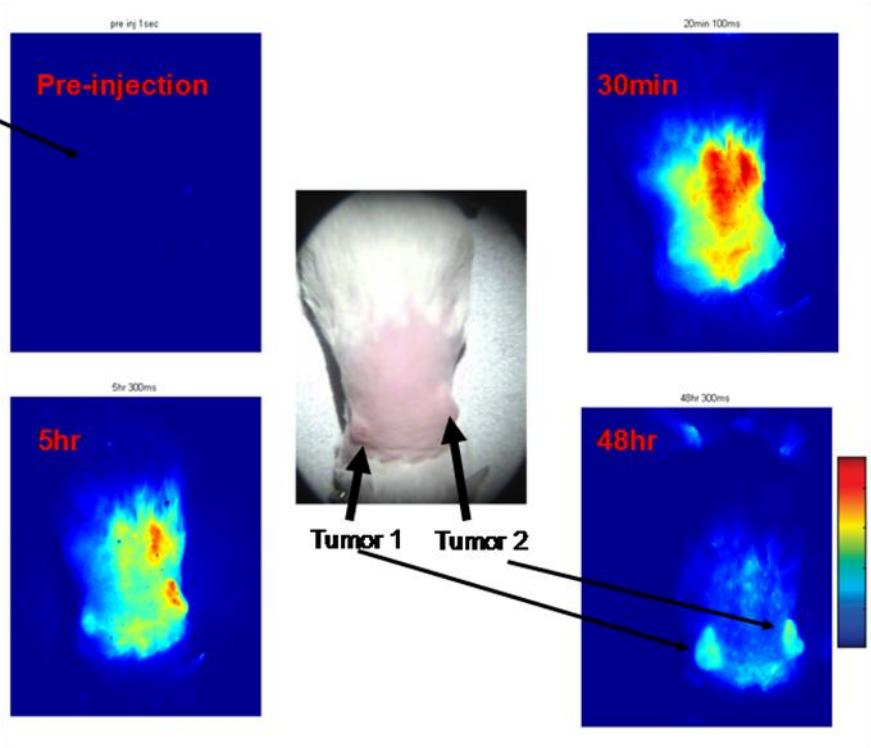
- **Tumors selectively heated and destroyed @ low power and SWNT dose.**

NIR Photoluminescence Imaging of Tumor

Autofluorescence of mice ~ 0

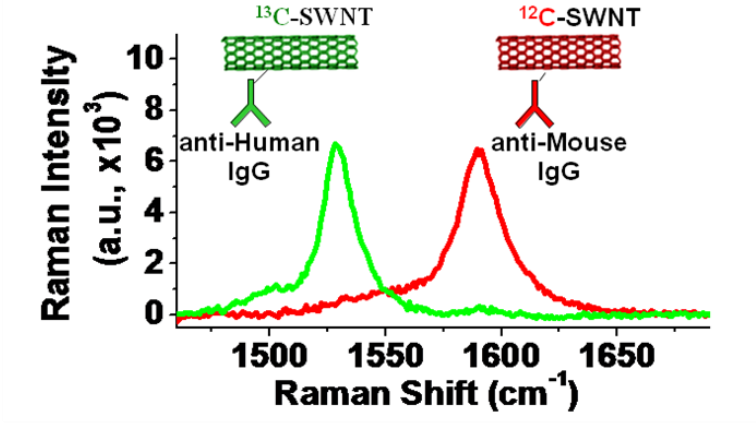
For cancer imaging & treatment

Josh Robinson et al., Nano Res., 2010

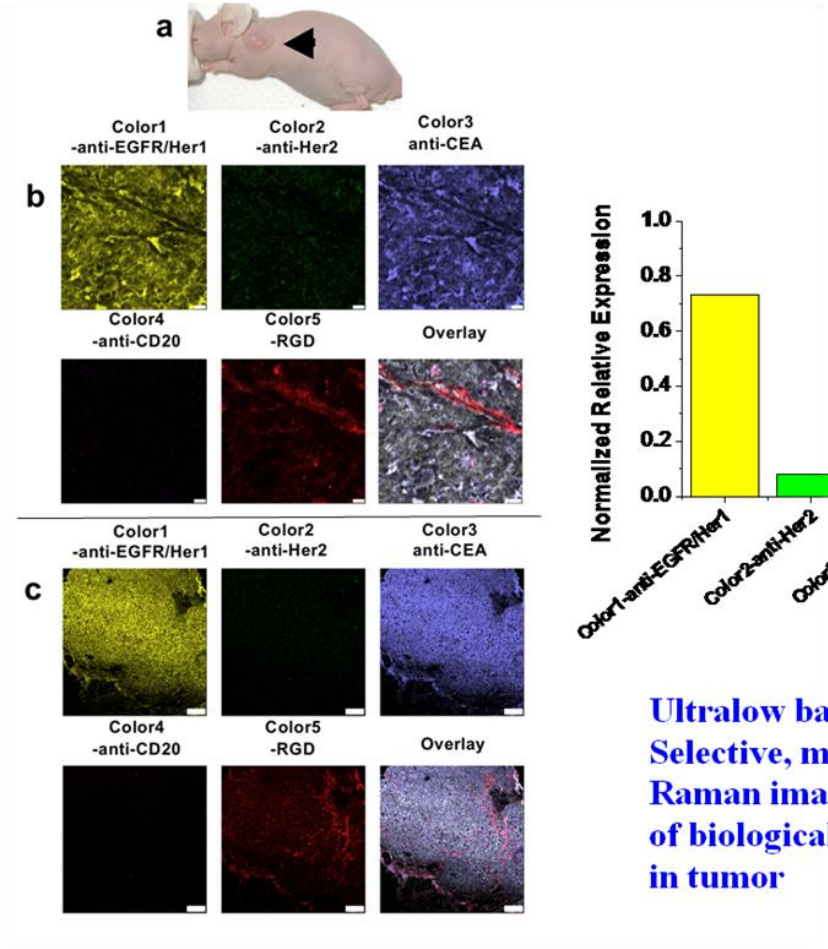


Multi-Color, Multiplexed SWNT Raman tags

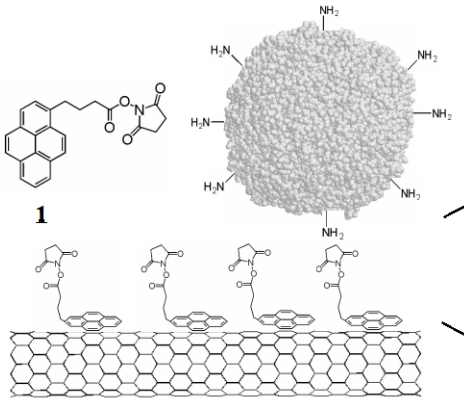
- C-12 and C-13 SWNTs: 2 Raman 'colors'.
- Conjugation of Human and Mouse IgGs respectively: 2-Plex.



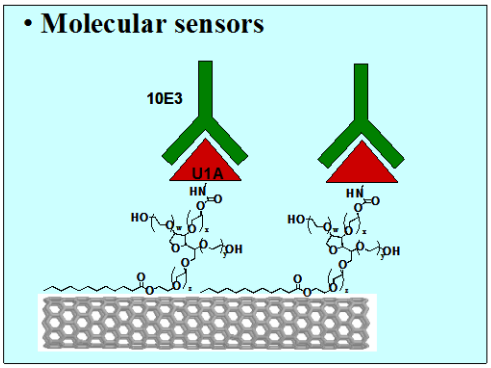
(Z. Chen, S. Tabakman, et al., **Nature Biotech.**, 2009)

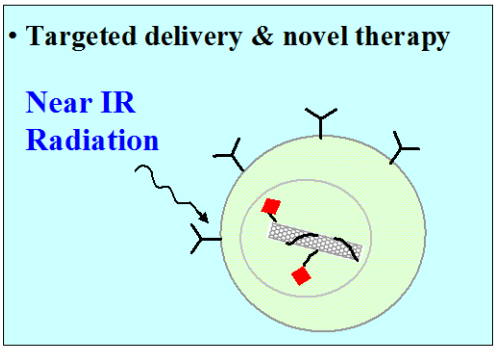


Ultralow background, Selective, multiplexed Raman imaging of biological targets in tumor



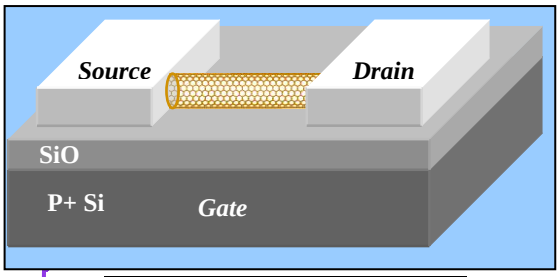
nanotubes + proteins, antibodies, DNA, RNA, or siRNA, ….

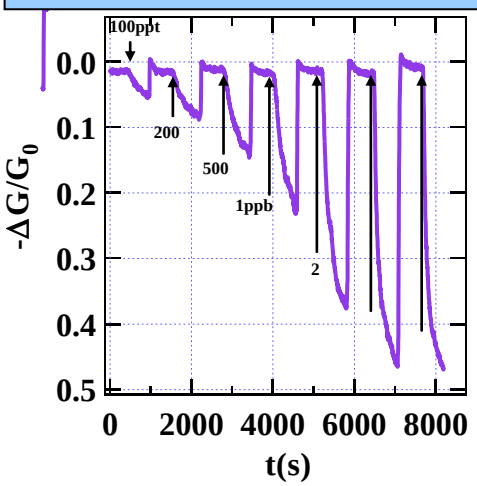




Jing Kong, Nathan Franklin, et al., *Science*, 2000
Robert Chen, Sarunya Bansaruntip, P. J. Utz, *PNAS*, 2002
Robert Chen, Moonsub Shim, Hee Cheul Choi

Nanotube Transistors for NanoSensors

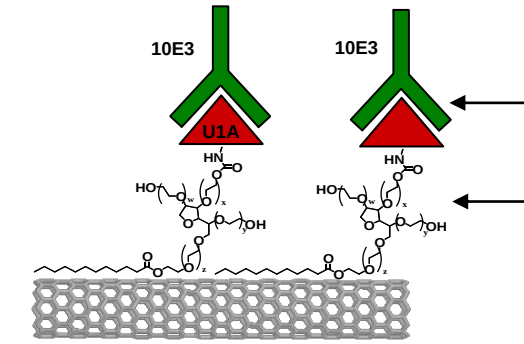




- **A single tube detects *part-per-billion* NO_2 gas**
- **The first nanotube/nanowire electronic sensor**
- **Label-free, electronic readout, small, rapid, sensitive, arrayable…**

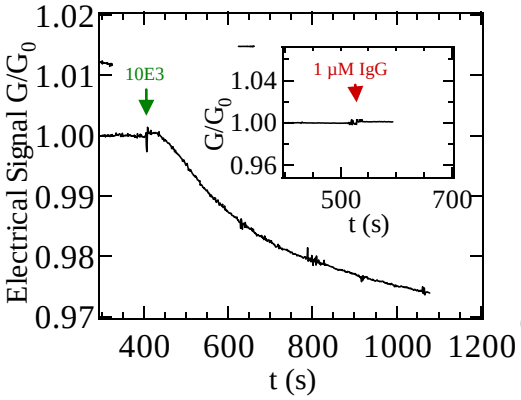
Kong, et al., **Science**, 287, 622, 2000
Qi, et al., **Nano Lett.**, 2003

Selective Electronic Biosensor For Autoimmune Disease Detection



Selective antigen-antibody binding

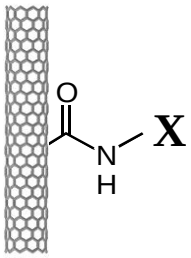
Polyethylene glycol chains:
prevent non-specific binding



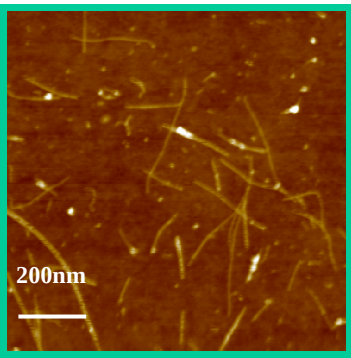
- Auto-immune disease: Systemic lupus erythematosus (SLE)
- Auto-antigen: U1A of spliceosome complex
- **10E3: monoclonal IgG raised against U1A**

Chen, et al., **PNAS**, 2002 (Dai & Utz Groups)

Nanotubes: New Types of Intracellular Transporters

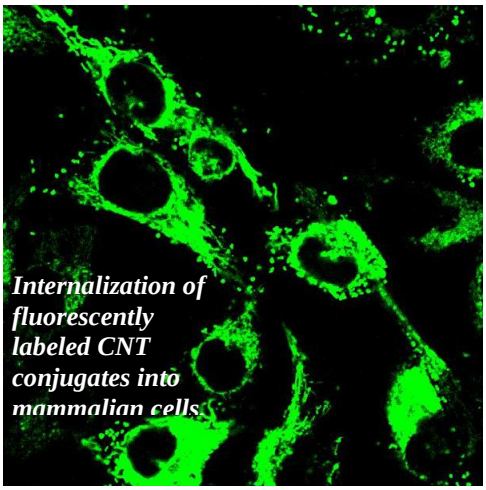


X = protein
or = DNA
= siRNA
=…



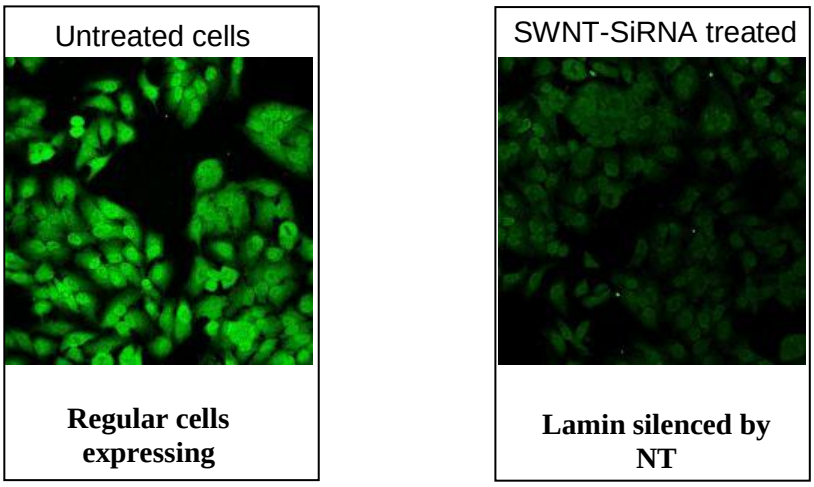
Length ~ 200 nm; various functionalization for water solubility

Nadine Wong Shi Kam, Zhuang Liu, et al.,
JACS, PNAS, Angew Chem. 2004-2005



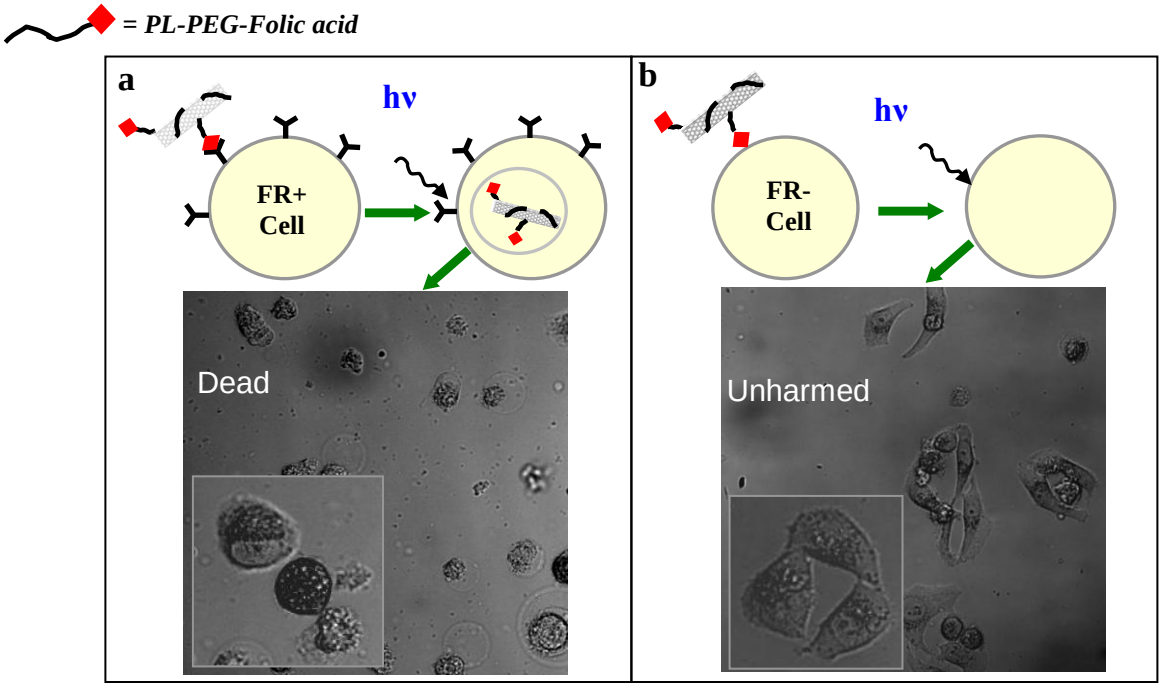
Nanotube Delivery of Short-Interfering RNA (siRNA)

- Lamin – intermediate filament protein forming nuclear lamina



N. W. S. Kam, JACS, 2005

Selective Delivery and Destruction of Cancer Cells by CNTs/NIR



N. W. S. Kam et al., PNAS, 2005