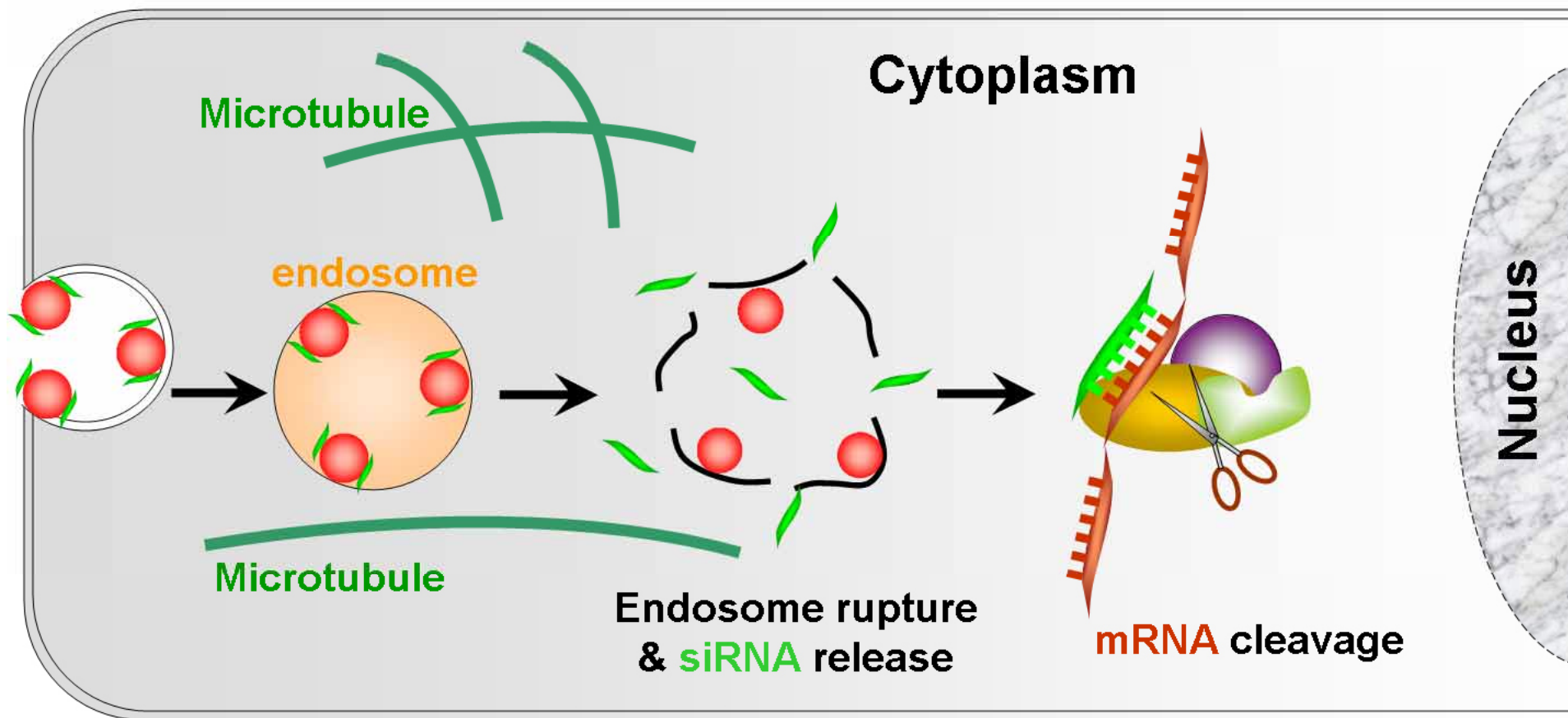


Multifunctional qdots for efficient delivery & real-time imaging of siRNA

Xiaohu Gao, Assistant Professor

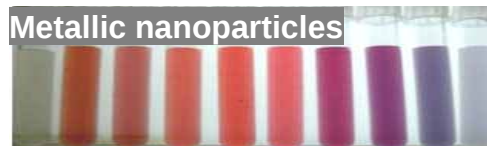
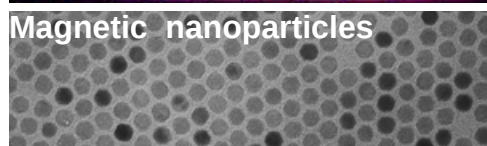
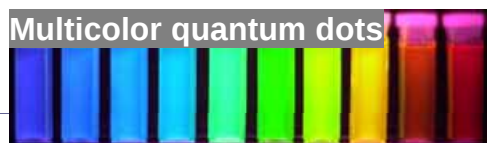
Department of Bioengineering
University of Washington, Seattle
<http://faculty.washington.edu/xgao>

Traceable siRNA delivery



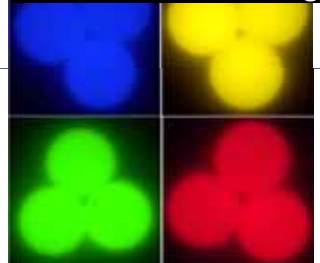
Nanotechnology & Molecular Engineering

Molecular Engineering of Nanotechnology

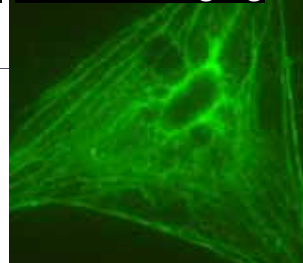


Molecular Diagnostics & Prognostics

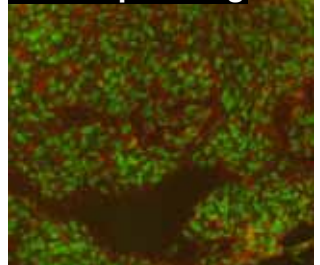
Molecular screening



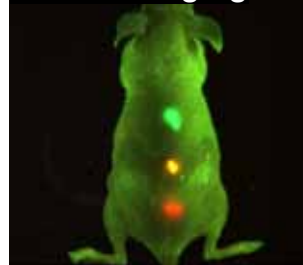
Cellular imaging



Tissue profiling

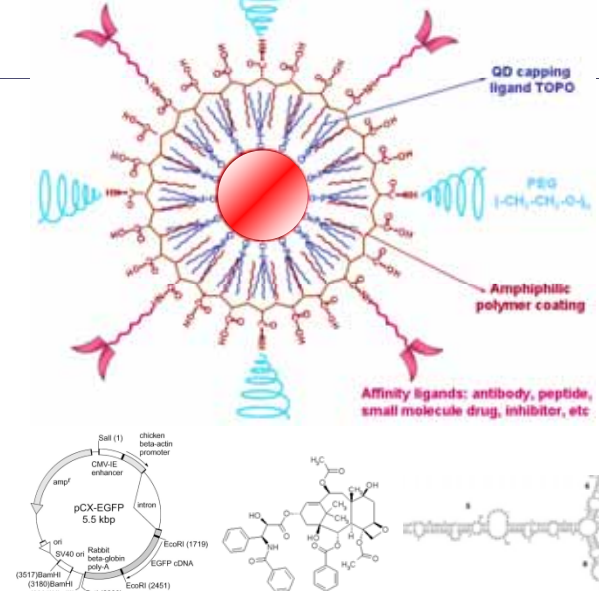


Animal imaging



Targeted Therapeutics

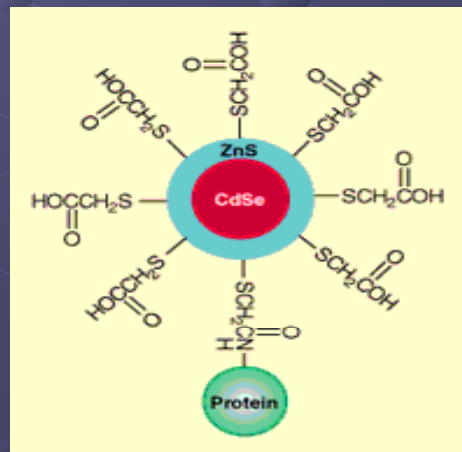
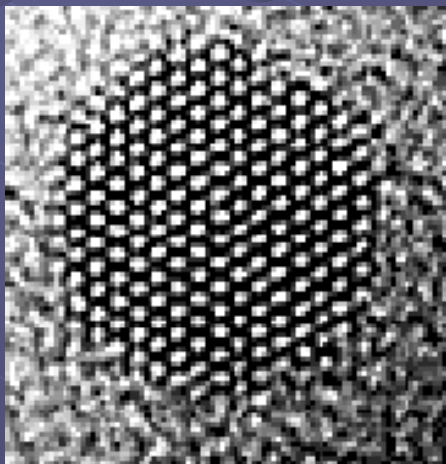
Multifunctional nanostructure



Technology optimization

Quantum Dots

- Semiconductor Nanocrystal
- Materials: Groups II-VI, III-V, eg. **CdSe**, CdTe, InP, InAs
- 2-10 nm in Diameter, similar to biomolecules
- Biolabeling, Colorful tags



Unique Optical Properties

1. Size Tunable Emission

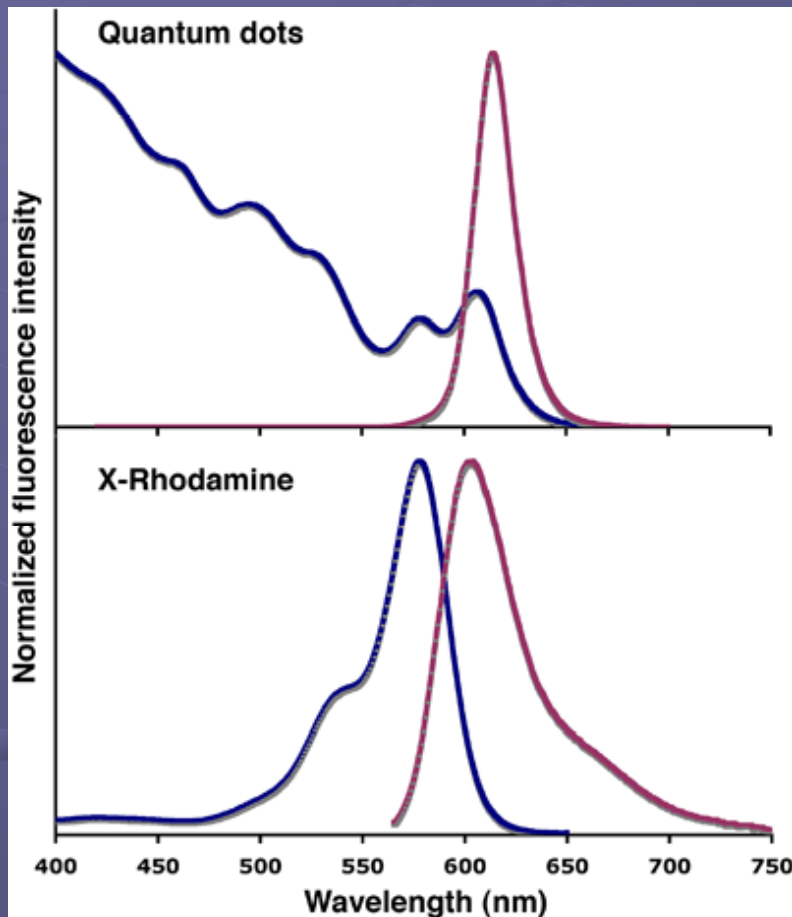
Small Particle (1.5nm) ---- (Blue)

Big Particle (5.5nm) ---- (Red)



Han, Gao, Nie, Nature Biotechnol. 19, 631-635 (2001)

2. Absorption & Emission Spectra



FWHM of QDs is about 1/3 as wide as that of a fluorescent dye

Symmetrical, Gaussian distributed emission

Broad absorption



Ideal for multicolor
Multi-analyte analysis



Gao et. al. QD Immunoassay, book chapter 2005

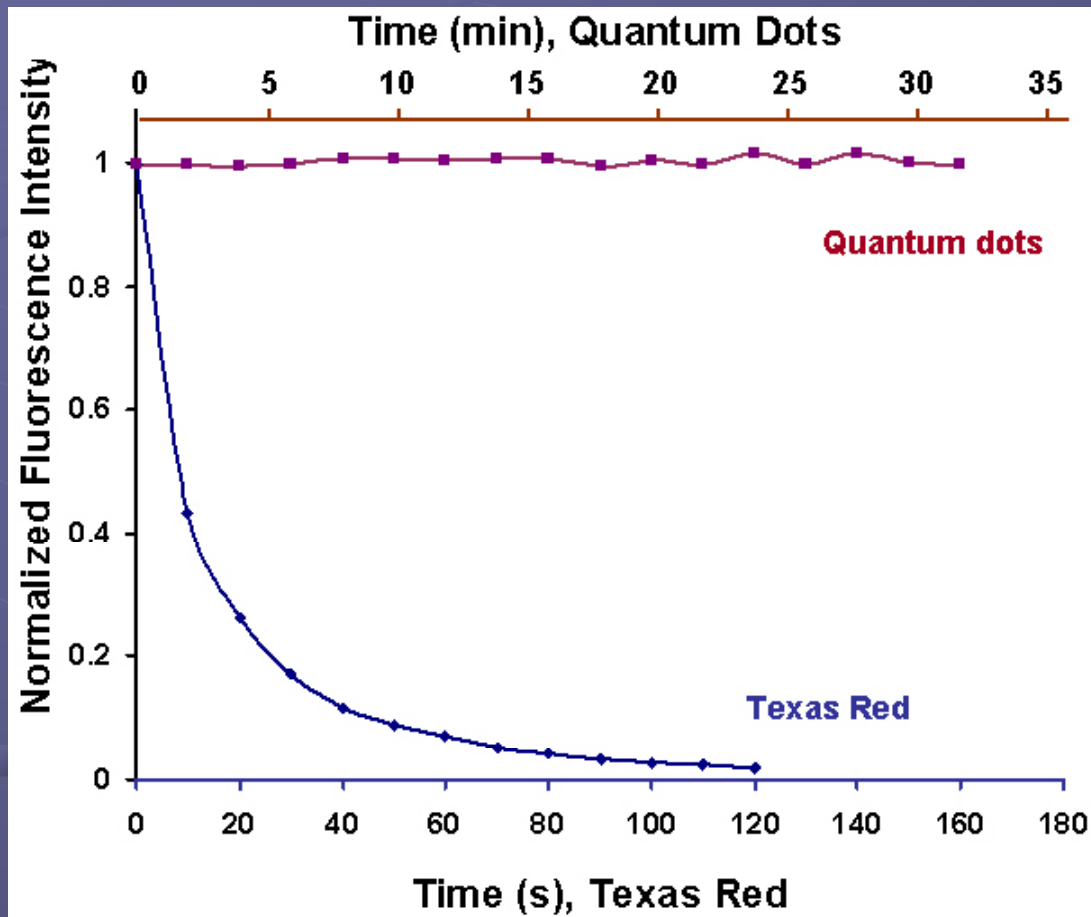
Han, Gao, Nie, *Nature Biotechnol.* 19, 631-635 (2001)

3. Brightness

Large absorption coefficient

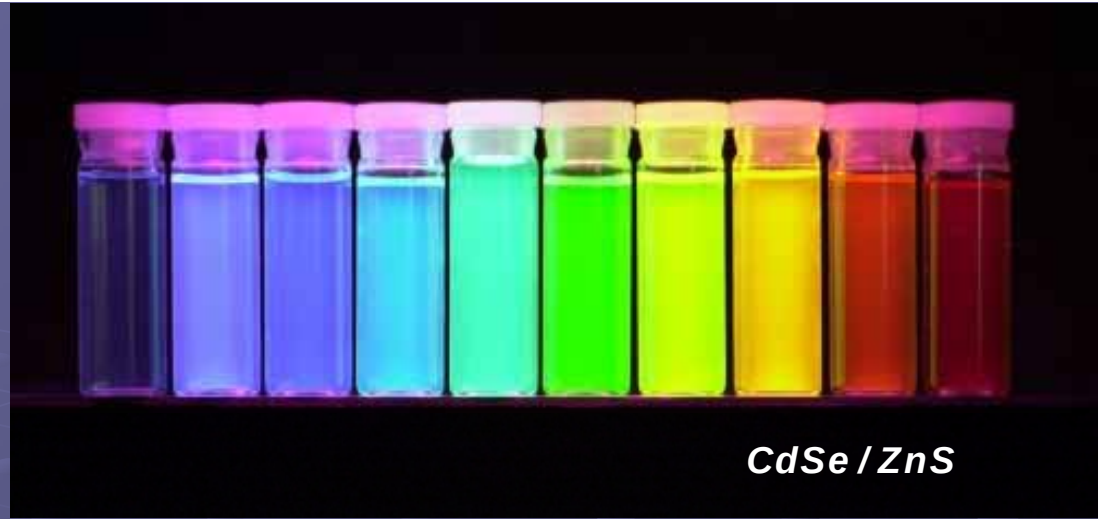


4. Photostability



1,000s times more stable than organic dyes

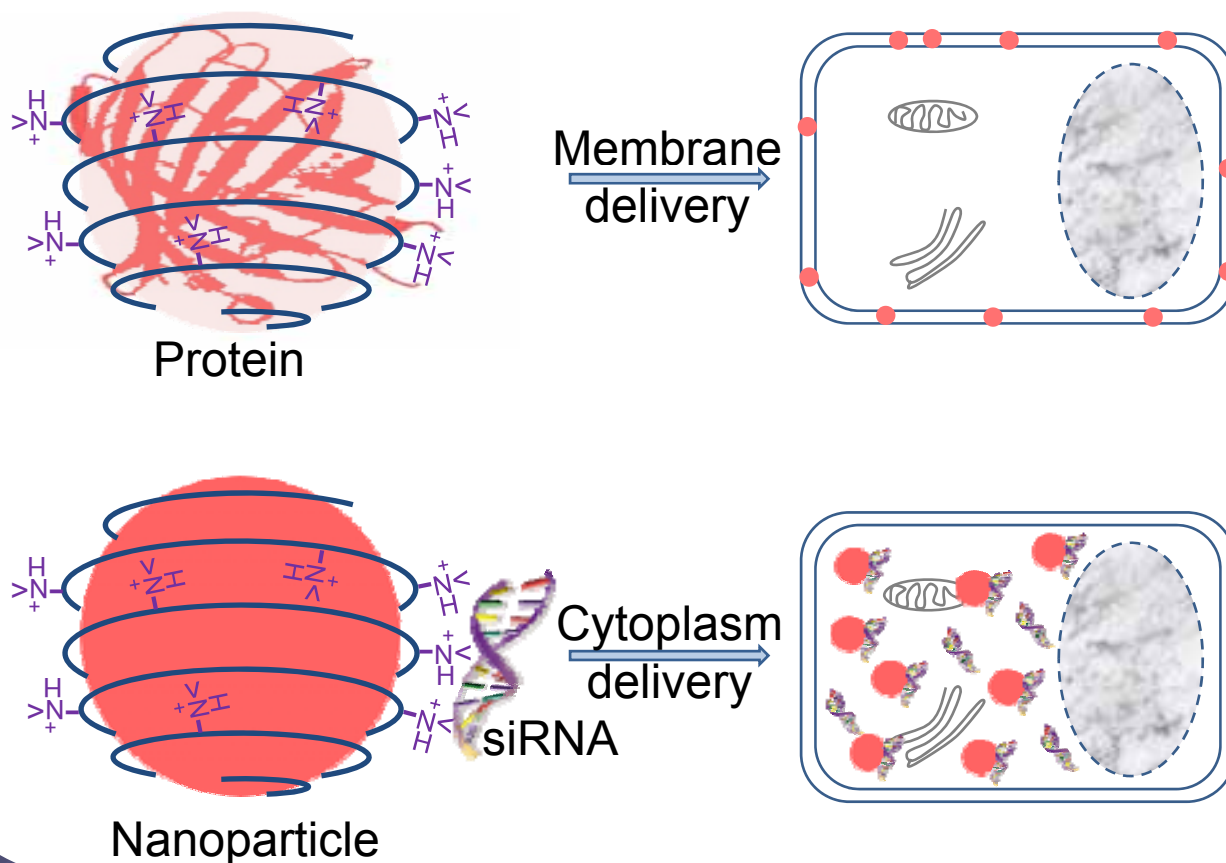
Quantum Dots



- **Highly Luminescent**
- **Large absorption coefficient**
- **Size/Composition Tunable Emission**
- **Photo-Stable**
- **Narrow, Symmetrical Emission Spectra**
- **Broad Absorption Spectra**
- **Large Stokes Shift**

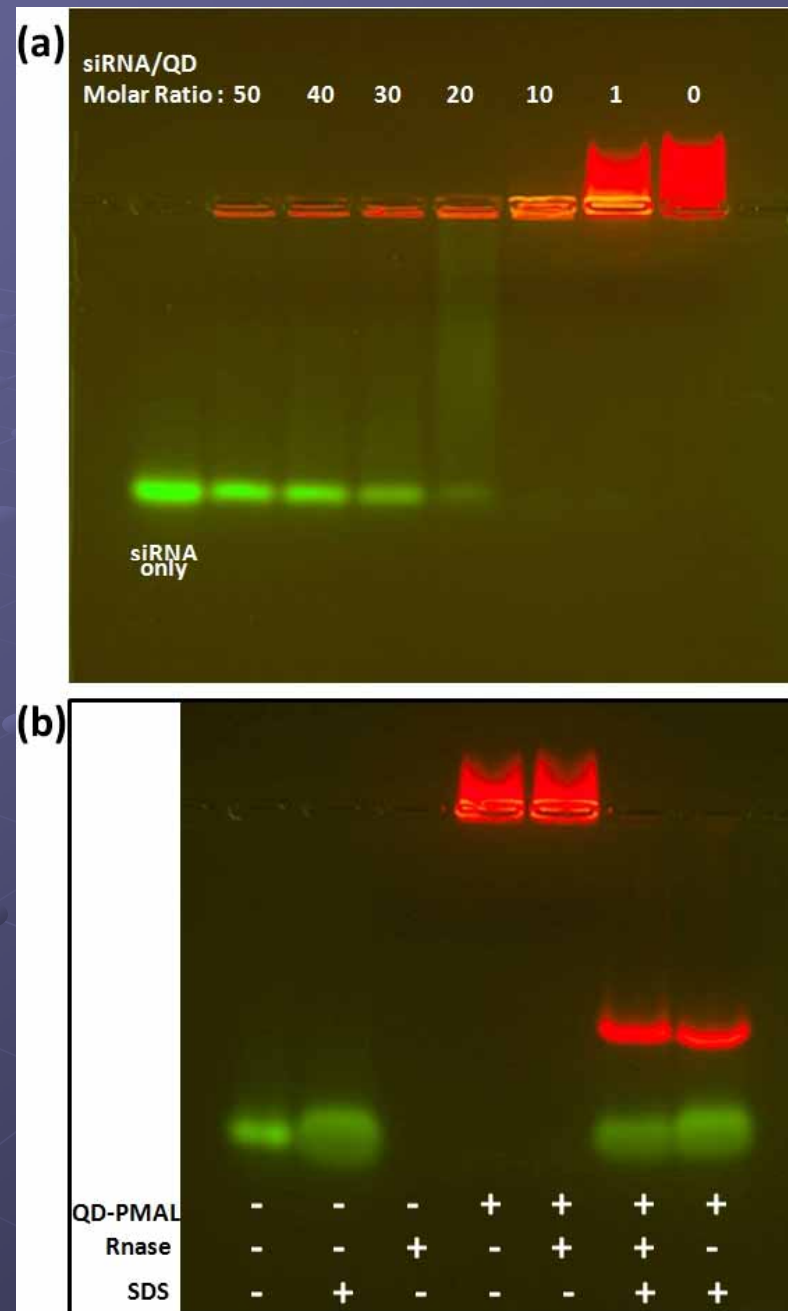
Probe for traceable siRNA delivery

NP – Amphiphilic Polymer

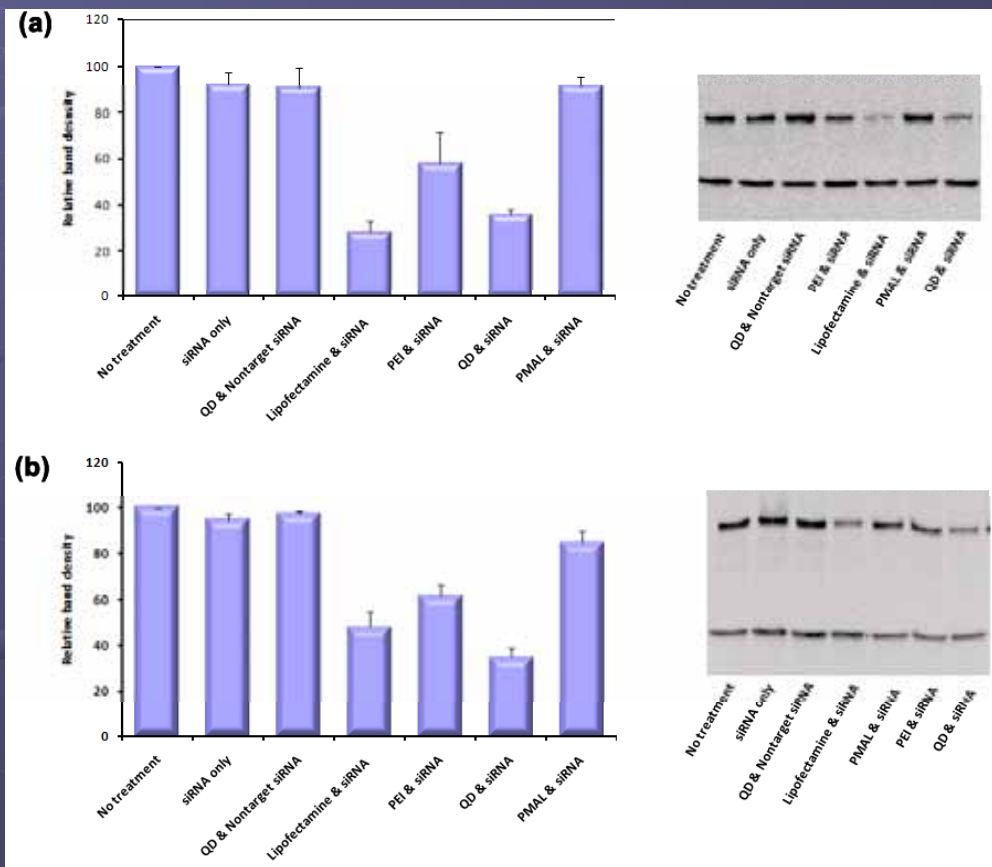
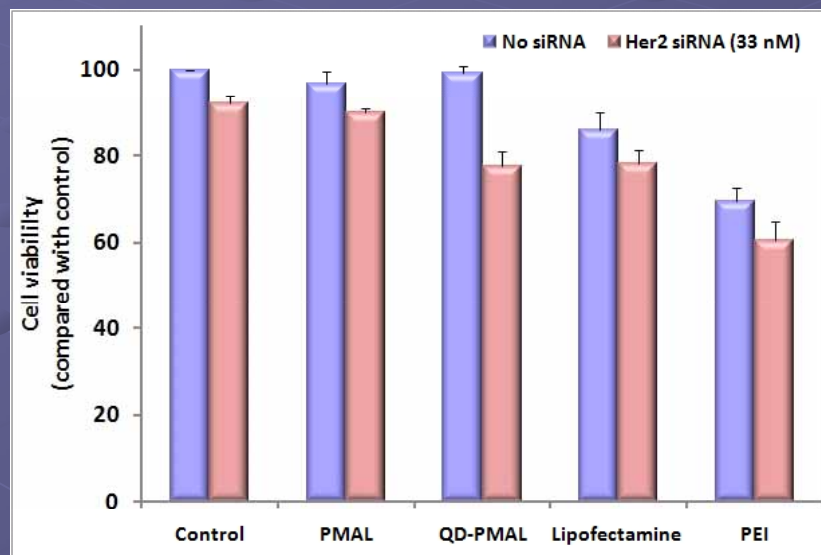


siRNA delivery

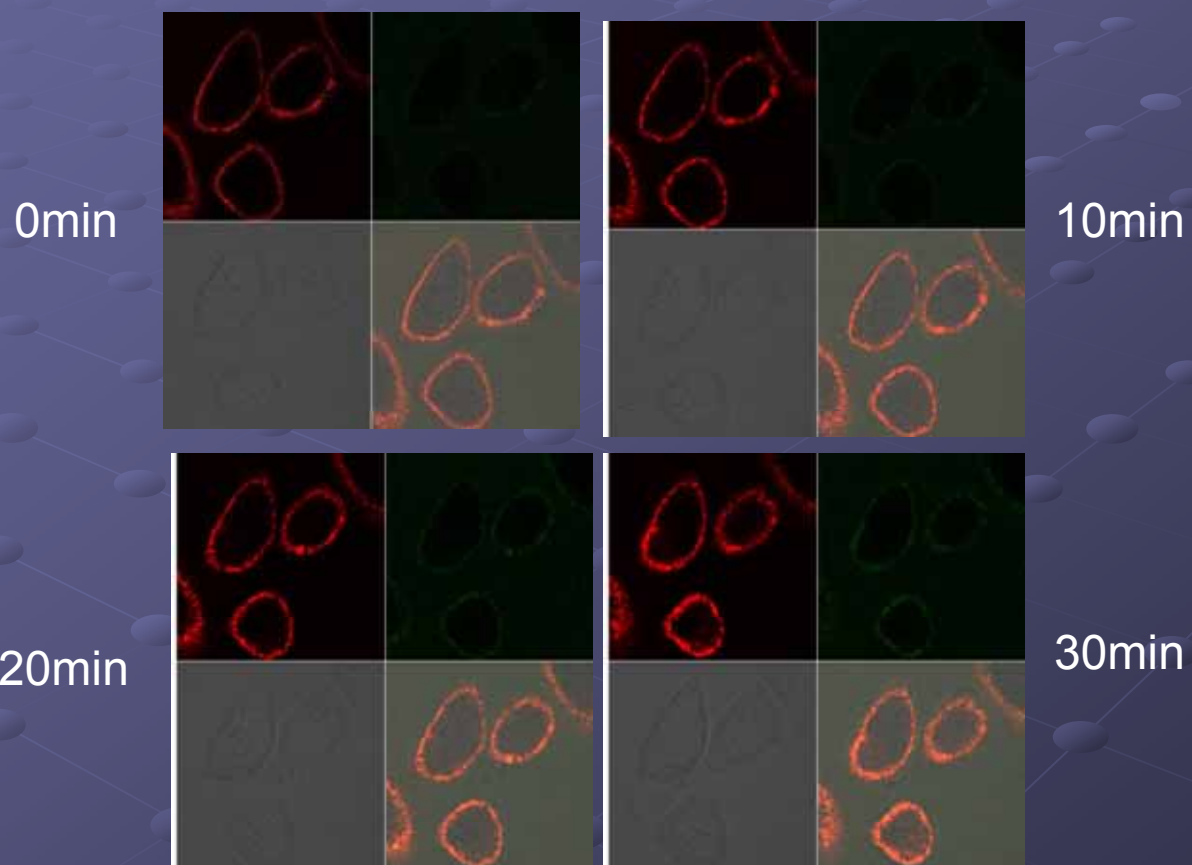
Qi & Gao, ACS Nano 2008



siRNA delivery

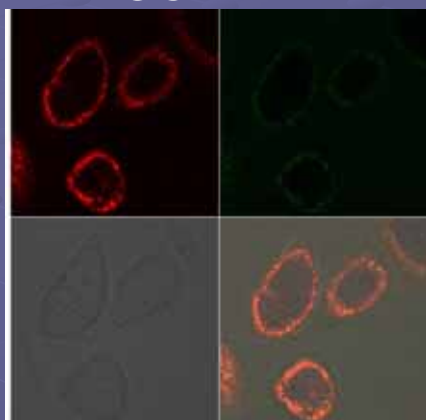


siRNA delivery

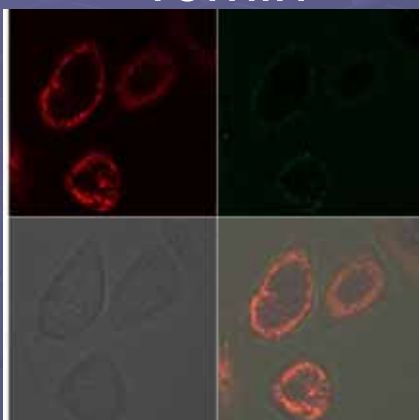


siRNA delivery

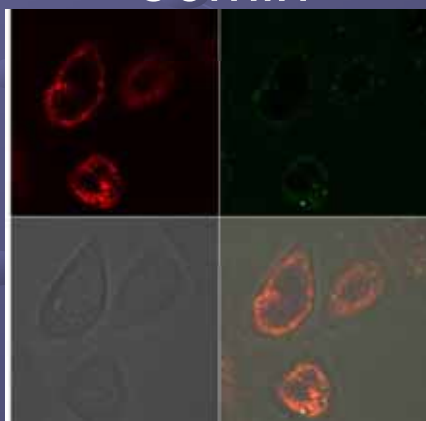
35min



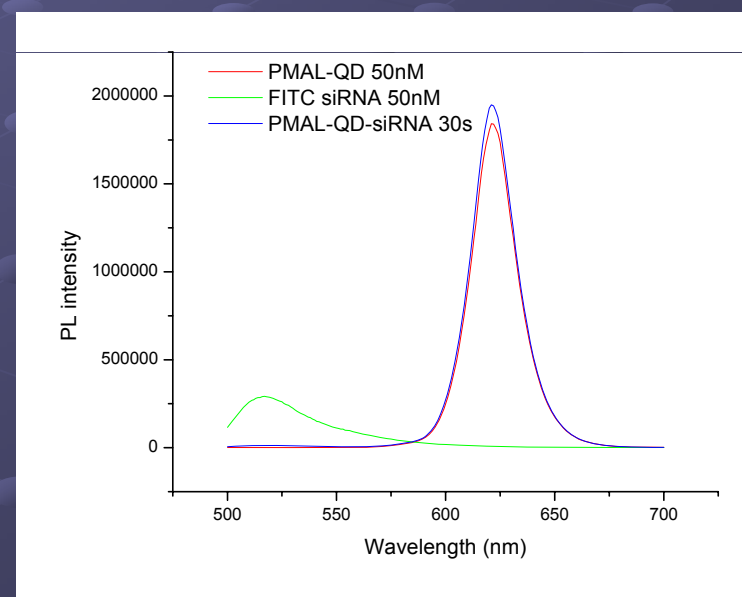
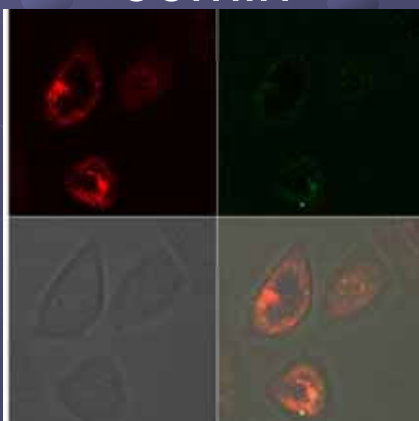
40min



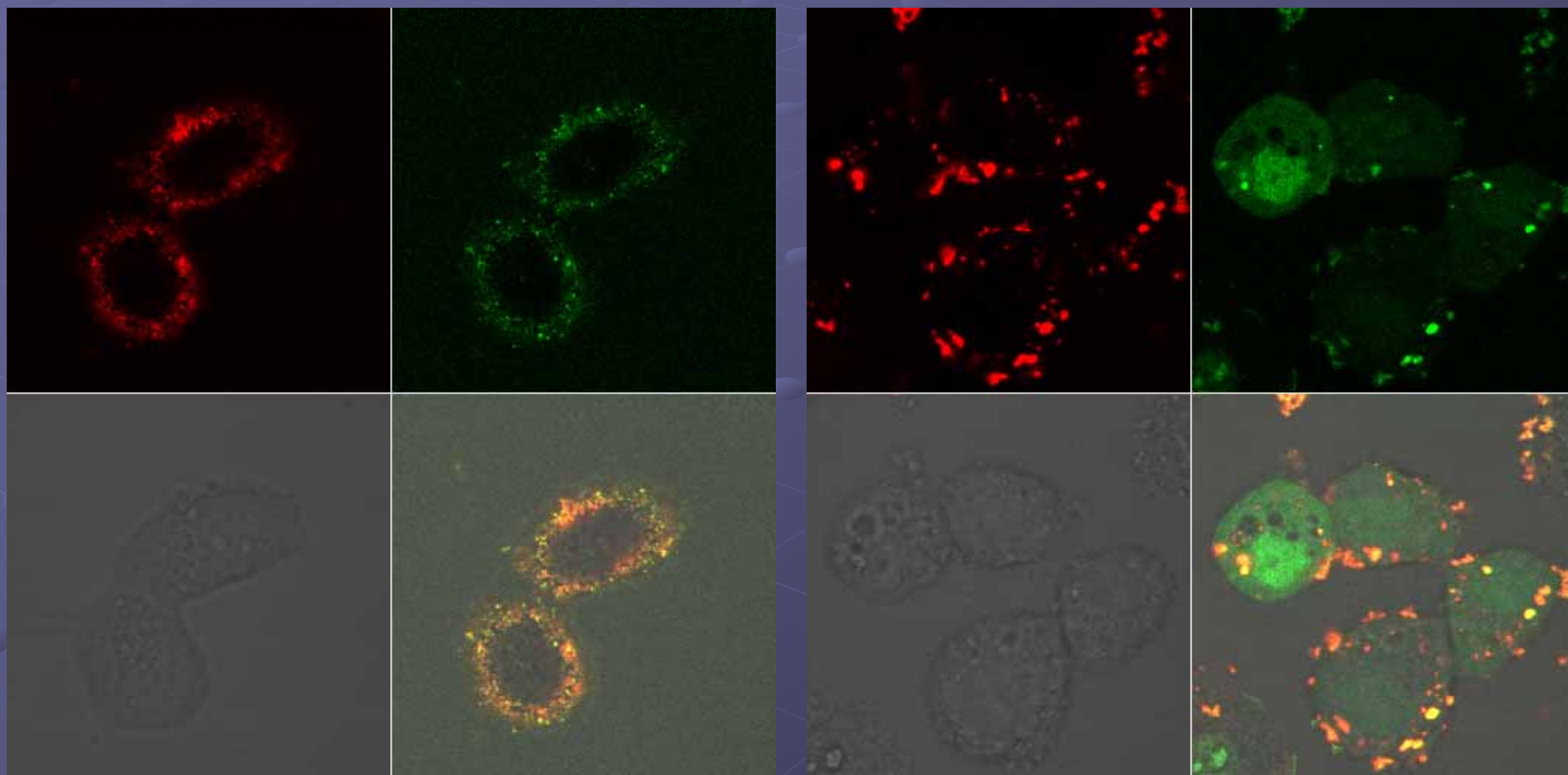
50min



60min



siRNA delivery



1.5 h

6 h

Summary

Challenges for traceable drug delivery

Introduction of semiconductor Q●

Surface engineering of Q●

Efficient delivery of siRNA

Imaging the delivery process in realtime

Targeted delivery to specific cell types
in vivo applications

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- Jian Yang, PhD
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