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Quantum Dot Gene Delivery for the Treatment of Neovascular Age-Related Macular Degeneration

Christian Lijo, Anthony Colella, Jordon Fox | Dr. Wan Shih, Dr. Wei-Heng Shih, Ajay Kuriyan

DREXEL UNIVERSITY School of Biomedical Engineering, Science and Health Systems

Need

- **Leading cause of blindness** in individuals ≥ **50**
- **Overexpression** of Vascular Endothelial Growth Factor (**VEGF**)

Existing:

- **Anti-VEGF drugs**: Repeated injections & potential side effects
- **Quantum Dots (non-viral gene delivery):** Potentially cytotoxic

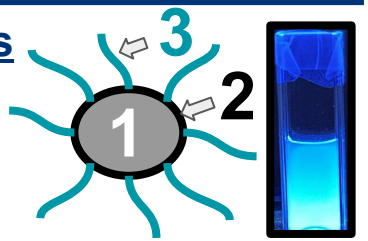
Objective

Develop a **non-cytotoxic** quantum dot vector capable of delivering a gene therapy

Solution

Quantum Dots

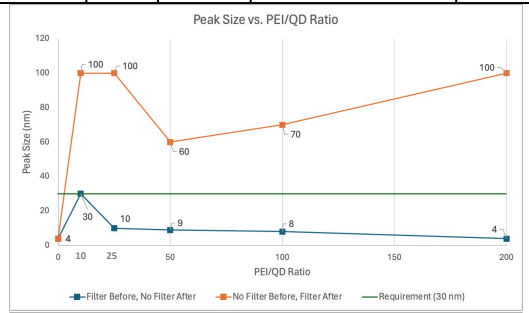
Nanoparticles capable nuclear transport and plasmid DNA delivery

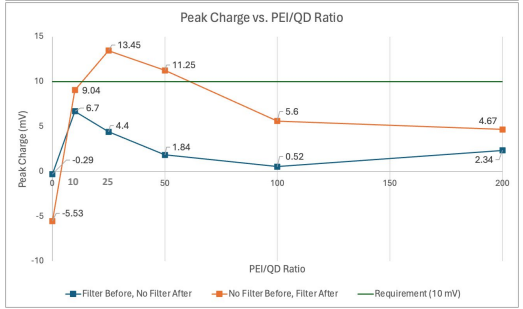


1 - Zinc Sulfide Core	2 - Capping Molecule (MPA/MPS)	3 - Polymer (PEI)
- Negatively charged - Nutrients - Photoluminescent	- Mercaptopropionic acid (MPA) & 3-mercaptopropyltrimethoxysilane (MPS) - Stability and protection	- Positively charged - Ratio of PEI:QD influences size and charge

Results

Filtering Condition (25:1 PEI:QD)	Size (nm)	Charge(mV)	Photoluminescence (a.u.)	Stability
Filter Before	10	4.4	110k	Fail
Filter After	100	13.45	96k	Fail





Design Inputs

C1: Biocompatibility - non-cytotoxic

R1: Size - ≤ 30 nm (nuclear transport)

R2: Charge - ≥ 10 mV (endocytosis)

R3: Photoluminescence - ≥ 200k a.u. (biotracker)

R4: Stability - maintain R1, R2, R3 for ≥ 72 hours

Future

Revisions:

- Builds with different conditions accomplish different requirements
- Further testing needed to identify optimal conditions & stronger stability

Impact:

- General gene delivery vehicle
- Biotracker to be used in research