Development of a Novel Blood-Brain-Barrier Transportable Nanotechnology for Selective Delivery of Radiological and Chemotherapeutic Agents in in-vitro and in-vivo Glioblastoma Cells

Co-Investigators

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Project Aims

Aim 1. Develop candidate EGFRvIII-targeted BBB transportable micro-nutrient based QDOTs by immobilizing targeting moieties on surface-engineered QDOTs via van der Waals interactions.

Aim 2. Determine GBM uptake and systemic uptake of targeted QDOTs compared to a nonfunctionalized QDOT controls in vivo.
Targeting Glioblastoma with Qdots

- Target: GBM EGFRvIII (over-expressed)
- Targeting agent: EGFRvIII nanobody, EGFRvIII antibody or peptide (such as CI-988, GE11).
- Delivery vehicle: Micronutrient based Qdots.
- Therapeutics: miRNA, traditional chemotherapeutic agent
- Imaging: Radioisotope (radio Zn-65 or I-124 labeled peptide–PEG–Qdots)

https://www.youtube.com/watch?v=wnUEqHZZM4k
Background and expertise
Bioimaging with Quantum Dots

BMC Biotechnology 2007, 7:67
www.probes.com
In vitro studies with Qdots

Fluorescence image of muscle stem cells labeled with multimodal Qdots

Fluorescence image of J77 murine Macrophages labeled with MQdots
TAT-Quantum Dots-Labeled Rat Brain

- Gross Fluorescence

  : Gross visualization of whole rat brain by handheld UV excitation

- Microscopic Images of Brain Capillaries and Tissues

  - TAT conjugated quantum dots
  : effective labeling of brain parenchyma without disruption of blood-brain-barrier (BBB)

Multimodal Quantum Dot-Labeled Multipotent Astrocytic Stem Cells (MASCs) Transplanted and Tracked in a Neonatal Rodent (mouse HI) Stroke Model

Three-dimensional MR (Gradient Echo) images of excised Hypoxic-Ischemia neonatal (mice) brain acquired at 17.6 T (A-C). The NP-labeled MASCs are colorized as purple. The needle track (white arrow) is clearly seen as are the MASCs moving toward the injured cortex. MASCs are also appreciated moving across the midline to the contralateral cortex and moving along the rostral migratory stream. (D) A grid overlay has been placed over the image to demonstrate the ability to obtain objective information about the distance of movement of the transplanted cells from the site of injection. Image acquisition: TE/TR = 7.5/150 ms

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Thanks for your attention!