Engineering Nanoparticle Shape to Deliver to 3D Tumor

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August 28th, 2013
Targeted Therapy for Cancer Treatment
Targeted Therapy

Healthy Cell

Cancer Cell

Nanoparticle used for drug delivery

antibody

receptor
Previous Study: Nanorods Target Better than Nanospheres

Nanospheres and Nanorods have greater bonding to cancer cell surfaces than nanospheres

Barua et al.; PNAS, 2013
Objectives

Improving Therapeutic Efficiency of Anti-Cancer Drugs

Hypothesis: Rods penetrate cells more than spheres
Methods: Preparation of Nanoparticles

Spherical shaped nanoparticles in a polyvinyl alcohol (PVA) film

PVA film is allowed to set for 18 hours

Place PVA film in metal stretcher and heat

Stretch PVA film; Prepare nanorods
Nanosphere and Nanorod Images
Scanning Electron Microscopy (SEM)

Nanoparticles were coated with a targeting antibody, Herceptin
Methods: In vitro 3-D Tumor Growth and Imaging

3-D Breast cancer cells treated with Herceptin-coated nanospheres and nanorods

24 Hour Incubation

Visualize the nanoparticle penetration and quantify the differences
Visualizing Nanoparticles in 3-D Breast Cancer Cells

Confocal microscopy allows analysis of nanoparticle penetration in 3-D cells
Comparing Nanorod vs. Nanosphere Penetration in 3-D Cells

We used a 3D imaging software to measure the penetration of the nanoparticles into cells.
Quantitative Measurements of Nanoparticle Fluorescence Intensity

Nanorods penetrated deeper into the cells than nanospheres
Summary

Application in drug delivery to complex tissues
Future Work
Thank you!

- Samir Mitragotri, my mentor Sutapa Barua, and Maarten Bakker
- Arica, Ofiela, Maria, Kevin and the CSEP Staff

...and the audience for listening!
Sliced view into the cells