Applying Gold Nanoparticles to Denature Proteins Characteristic of Alzheimer’s Disease

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Introduction

• This experiment investigated whether the plasmonic properties of 800 nm near-infrared resonant gold nanorods, and their consequent ability to generate localized heat, could serve as a mechanism to denature beta-secretase (BACE).
• BACE is one of the enzymes responsible for cleaving amyloid precursor protein to produce the hallmark amyloid plaques of Alzheimer’s pathology, and has become a favored target for Alzheimer’s drug development in recent years.
• The results of this study suggest that by conjugating gold nanorods with BACE via anti-BACE antibodies and polyethylene glycol, BACE was denatured upon irradiation with near-infrared light. These findings may serve as a platform for addressing the shortcomings of past drug development for Alzheimer’s disease, and the mechanism for drug delivery may have its own diverse array of applications.

Methods

• Bind PEG to Antibody

• Bind Antibody-PEG Conjugate to Gold Nanorods

• Bind Gold Nanorod-PEG-Antibody Conjugate to BACE

• Measure Tryptophan Fluorescence in Plate Reader
• Irradiate Gold Nanorod-PEG-Antibody-BACE Conjugate
• Perform Control Tests

Results

Based on the tryptophan fluorescence graphs, there was a significant difference between the peaks before and after irradiation for the gold nanorod-PEG-antibody-BACE conjugate. This suggests that the irradiation of the conjugate with 800 nm near-infrared light successfully denatured BACE. Furthermore, the results of the control tests suggest that only by targeting BACE using an antibody-gold nanorod complex with near-infrared light was BACE denatured.

Conclusions

Next Steps in Alzheimer’s Research
In order to serve as a viable therapeutic, further research must confirm that the gold nanorod complex is capable of crossing the blood-brain barrier and that the irradiated nanorods do not damage nearby neurons.

Targeting Enteroviruses
Previously it was found that when the protein SETD3 was knocked out in mice, it prevented enteroviruses from reproducing. Gold nanorods could target and denature SETD3 in vivo, possibly generating temporary immunity against enteroviruses.

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References