CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP100189

Project Title:
Systemic Cancer Immunotherapy Using Gold Nanoparticle Loaded Tumor-Specific Cytotoxic T Lymphocytes

Award Mechanism:
High Impact/High Risk

Principal Investigator:
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Entity:
Rice University

Lay Summary:

Cytotoxic T lymphocytes injected intravenously circulate through the body and migrate preferentially to tumors, where they recognize and kill tumor cells expressing the target antigen. Because of the natural tumor-homing ability of T cells, several groups have exploited T cells to deliver therapeutic payloads to tumor sites, thereby increasing the specificity of therapies. In this project, we assess a new cancer treatment approach leveraging the combined advantages of immunotherapy and gold nanoparticle-mediated photothermal cancer therapy, a method which destroys tumors through photothermal ablation achieved by application of near infrared laser light to tissue containing gold nanoparticles where gold nanoparticles have accumulated. We hypothesize that more effective gold photothermal therapy will be possible using T cells serving as therapeutic vehicles for delivery of gold nanoparticles, improving the accumulation of nanoparticles at the tumor by active T cell migration from the peripheral blood to the malignancy. We will first assess whether the active process of T cell migration results in enhanced anti-tumor activity for T cell assisted gold nanoparticle photothermal therapy compared against conventional photothermal therapy using pegylated gold nanoparticles delivered based on passive diffusion. We propose that use of tumor-specific cytotoxic T lymphocytes will further improve this therapy by increasing the immediate anti-tumor effect initiated by gold nanoparticle photothermal therapy and by providing residual anti-tumor immunity following photothermal ablation. Finally, we will capitalize on these effects by subsequent adoptive T cell immunotherapy. We anticipate initial tumor destruction by gold nanoparticle and cytotoxic T lymphocytes will cause inflammation at the tumor site which will attract additional tumor-specific cytotoxic T lymphocytes. In summary, this project will assess whether a therapeutic approach using a combination of photothermal ablation and T cell immunotherapy provides a superior therapeutic response to what either technique can achieve alone.