Optimization of Lipid-Coated Mesoporous Silica Nanoparticles for Cancer Immunotherapy

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Cancer immunotherapy is an important alternative to traditional treatments such as chemotherapy and radiation, reducing the toxicity and negative side effects. By eliciting an immune response against the cancer cells and possibly causing immunological memory, where the immune system remembers and responds to foreign substances that it has encountered previously, immunotherapy can be an effective treatment for cancer, resulting in long-term remission. Past studies have demonstrated the use of mesoporous silica nanoparticles (MSN), particles that are engineered to have lots of pores, as delivery vehicles for various cargos, including proteins and nucleic acids. By utilizing monophosphoryl lipid A (MPL), which is clinically being used as an adjuvant in vaccines to help stimulate and enhance the immune system's response, as well as a model antigen, which is a substance that can create an immune response, novel immunogenic MSNs can be created to elicit immune responses specific for the antigen. In this study, a vaccine against the model antigen ovalbumin is being developed by optimizing immunogenic lipid-coated mesoporous silica nanoparticles (LC-MSNs) for MPL and ovalbumin loading. LC-MSNs with different liposomal formulations were tested for their activation of an immune response and ovalbumin retention. Results indicate that insertion of the negatively-charged lipid DMPG in the lipid coating allowed for two-to three-fold increase in retention and exposure of MPL, higher ovalbumin processing and presentation, and uptake by mainly macrophages, ultimately allowing for a higher immunogenic response.

Awards Won:
Second Award of $2,000