ND*nano* Undergraduate Research Fellowship (NURF)
2011 Project Summary

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Project title: Engineering multifunctional nanoparticles to overcome drug resistance in multiple myeloma

Multiple myeloma is a malignancy of the plasma cells, which is characterized by tumor development in the bone marrow. Unfortunately, because of interactions with the bone marrow environment, the tumor develops resistance to cancer drugs such as doxorubicin. This resistance, caused by cell adhesion mediated drug resistance, makes multiple myeloma presently incurable.

The goal of the project I worked on this summer was to create a nanoparticle that has the ability to overcome this cell adhesion mediated drug resistance and then destroy the tumor. In order to achieve this goal, it was necessary to find a peptide sequence that is specific to the alpha-4 beta-1 (VLA-4) receptors on the tumor surface. This allows for the nanoparticle to be taken up into the tumor so that the cancer drug will be delivered more effectively to only the tumor. When I began my work in the lab this summer, the group was beginning to analyze the data of a preliminary trial performed on eight mice using the doxorubicin-loaded nanoparticles. The results from the preliminary trial were positive and we therefore decided to begin a second trial on thirty-two mice. During the summer, I synthesized the required targeting peptide and conjugated it to a lipid to be included in the micellar nanoparticle using solid support peptide synthesis and Fmoc chemistry. Additionally, I researched alternative cancer drugs to incorporate into the nanoparticle instead of Doxorubicin. Furthermore, I experimented with the possible chemistry techniques to use in order to conjugate that drug into the nanoparticle.

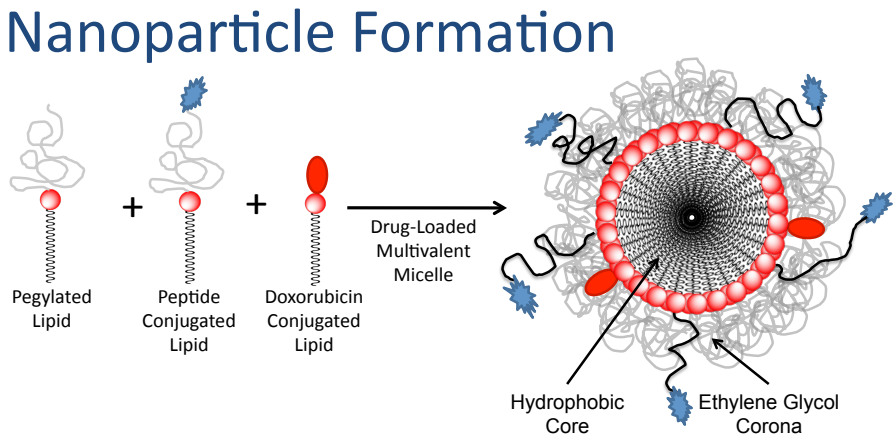

Fig. 1. Cartoon of micellar nanoparticle to be injected into mice that consists of a Peptide-conjugated lipid, a Doxorubicin-conjugated lipid, and a pegylated lipid.