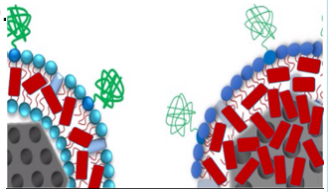
Modified Surface Strategies for Protocell Delivery of Cancer Therapeutics

Jacob Erstling
Florida International University
Mentor: Paul Durfee
PI: C. Jeffrey Brinker

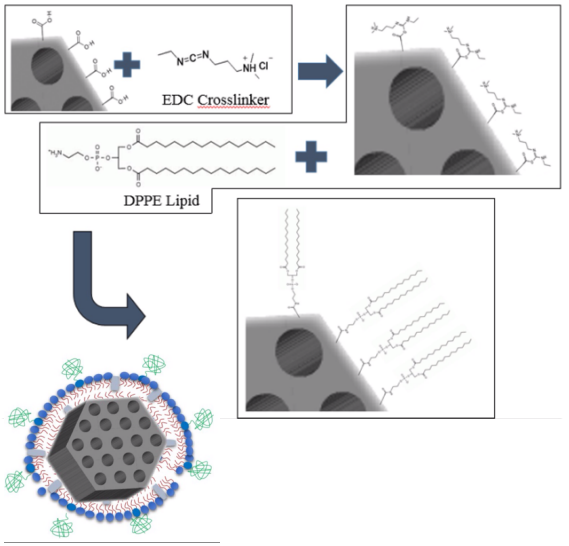
Problem: Many cargos, including those that treat cancer, are hydrophobic. Due to hydrophobic interactions, these cargos are limited to the hydrophobic region of the lipid bilayer on the original protocell design.

Goal: By modifying the mesoporous silica nanoparticle (MSNP) core to be hydrophobic, we can theoretically form a "hybrid bilayer protocell" with a lipid monolayer to provide more loading space for hydrophobic cargo.



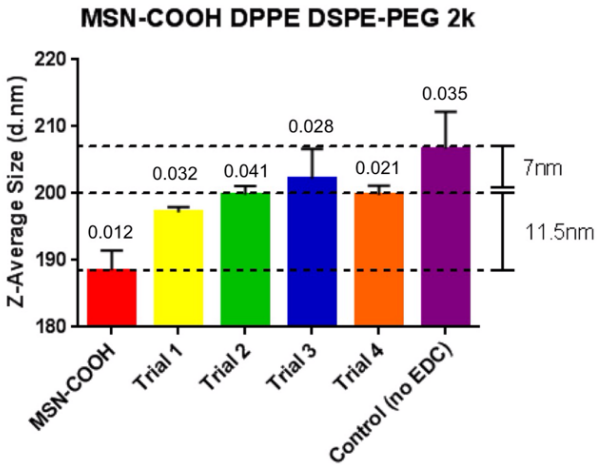
Method:

- By carboxylating the MSNP, the primary amine on various lipids can be anchored, using a crosslinker, to the carboxylic acid to form an aliphatic hydrophobic monolayer
- Lipid moieties can then be directly fused to the modified MSNP to form a hybrid bilayer protocell



Results:

- Trials 1-4 (those that used EDC crosslinker) may have formed a lipid monolayer
- The control (no EDC crosslinker) may have formed a lipid bilayer
- Control aggregated on day 6 while trials 1-4 remained stable, indicating that anchoring method improves stability



Future Directions:

- Further characterization of hybrid bilayer protocells needs to be obtained, including Transmission Electron Microscopy and Brunauer–Emmett–Teller adsorption
- Drug loading and release needs to be quantified and optimized
- Circulation and cellular uptake will be observed via *in vitro*, *ex ovo*, and *in vivo* observations