

Development of Synthetic Cellular Mimics

By: Katherine Latimer PI: Bryan Kaehr



Problem

- The ability to bridge biological structures/functions to synthetic materials and devices is a scientific grand challenge.

Overarching Goal

- Create synthetic materials that match the structural, mechanical and functional properties of biological cells.

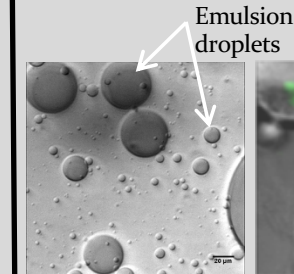
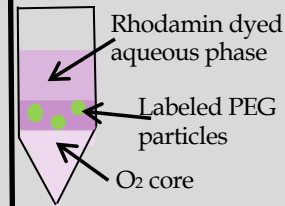
Project Goal

- Synthesize artificial red blood cells to develop a non-immunogenic universal carrier.

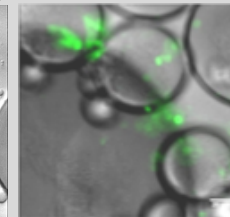
Approach

- Polyethylene glycol (PEG) hydrogel RBC-like particles are derived from mesoporous silica cell replicas.
- Particles are loaded with an oxygen carrying core (Perfluorodecalin; PFD) using emulsification formulations to create fluorocarbon phases stabilized within RBC polymer particles.

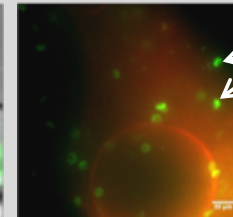
Results



Emulsion without particles



Labeled particles in emulsion



Rhodamin dyed emulsion with labeled particles

Labeled PEG particles in emulsion

Determining particle/emulsions interactions using optical and fluorescence microscopy.

Emulsion Surfactant	Charge	Particle localization to PFD emulsion
F-68	0.213 mV	✓
PEG	1.28 mV	✓
BSA	-0.785 mV	✓
F-68/BSA	-1.14 mV	✓

Future Directions

- Determine encapsulation efficiency of PFD within the polymer RBC
- Tune chemistry of polymer particles to stabilize the fluorocarbon core
- Evaluate the O₂ carrying efficiency using spectroscopy (FTIR, UV-Vis) and Raman microscopy to evaluate encapsulation of oxygenated core