

# ***Examining Functionalized Vesosomes as an Improved Drug Delivery Vehicle***

**Jason Schmidt**

Allan Hancock College

Bio-Engineering major

INSET Mentor: Ben Wong

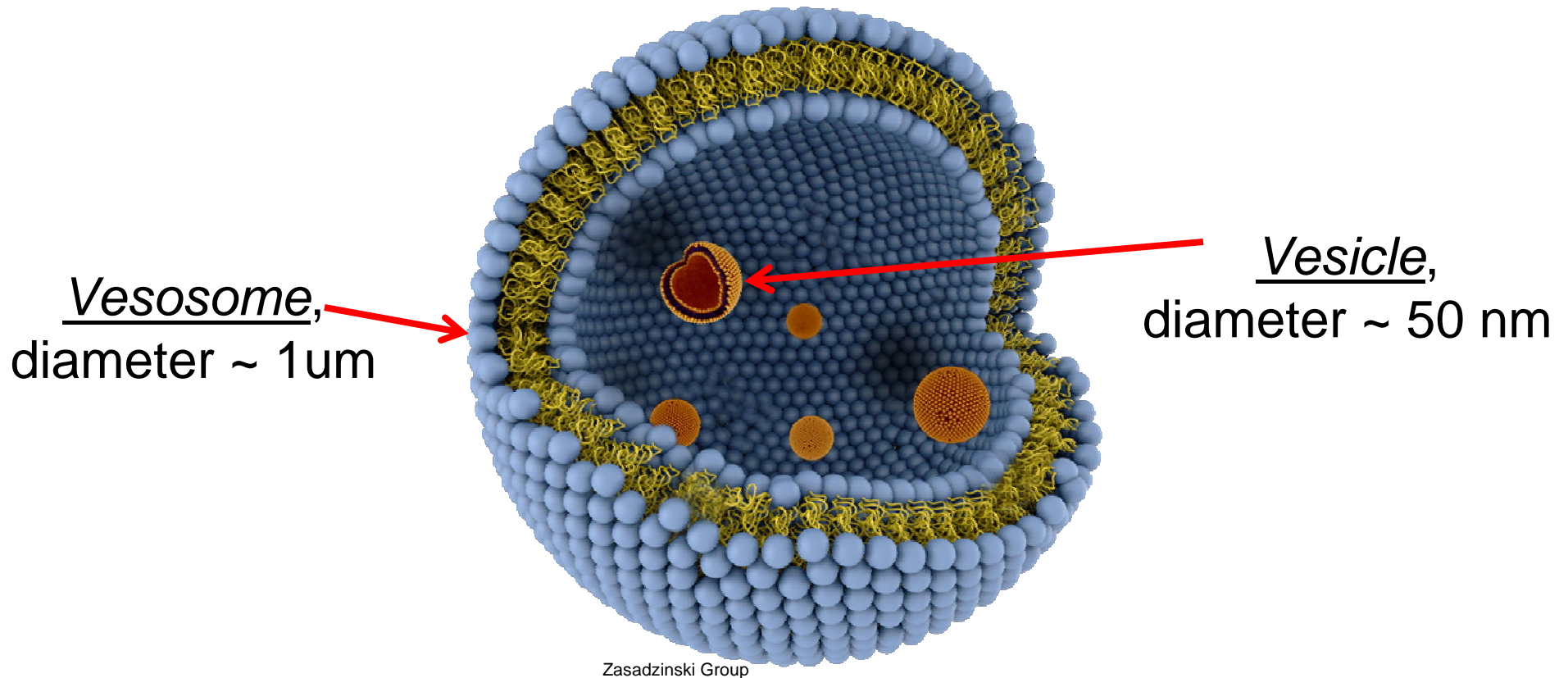
Faculty Advisor: Joe Zasadzinski

UCSB Department of Chemical Engineering

*Funding By:*

- *Program of Excellence in Nanotechnology (PEN)*
- *National Institutes of Health (NIH)*
- *National Science Foundation (NSF)*

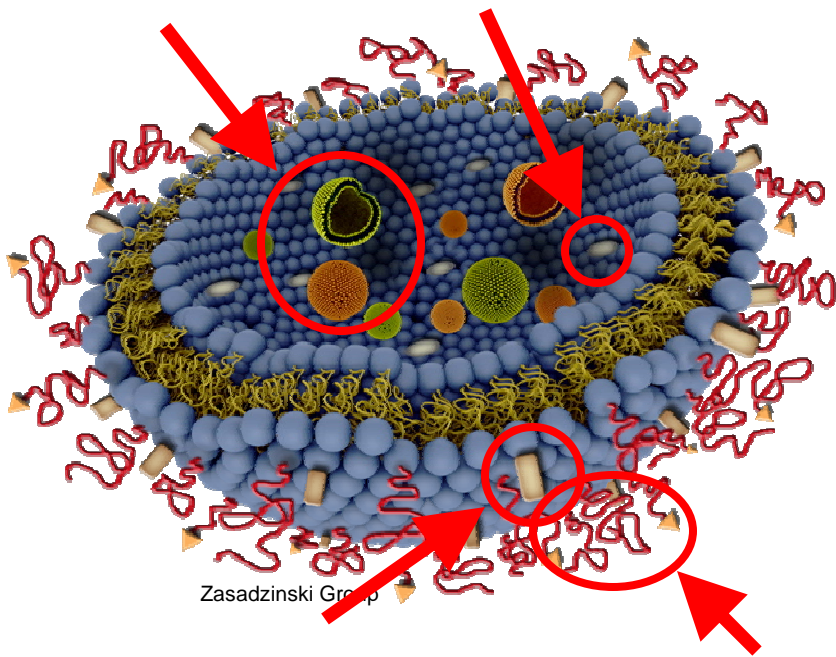
# What Is A Vesosome?



- A vesicle is a tiny phospholipid bi-layer “bubble”
- A vesosome is a comparably larger vesicle that encapsulates many smaller vesicles

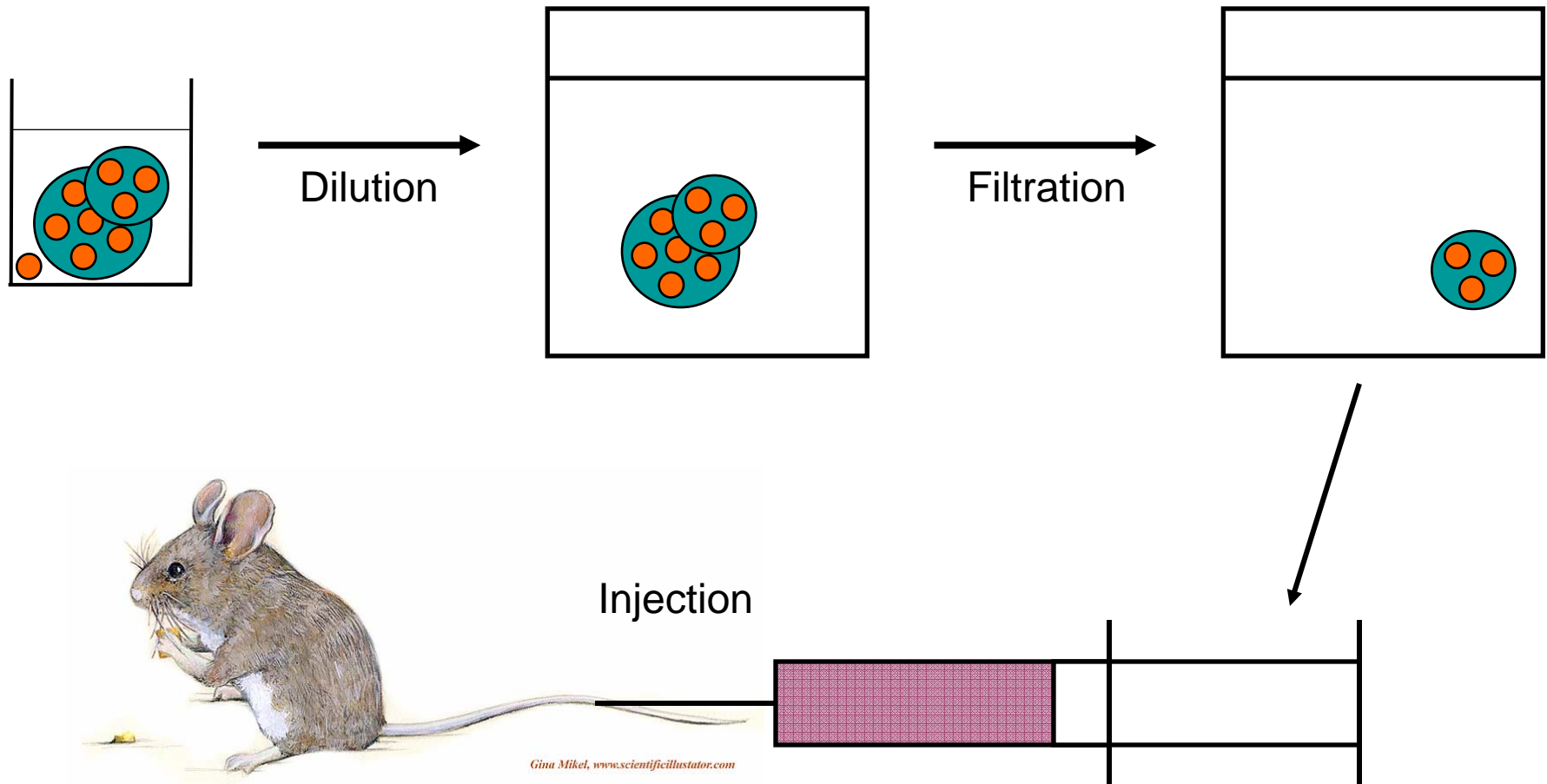
# *The Potential to Greatly Increase the Efficiency of Drug Therapies*

- Increase in drug retention in vivo
- Reduction in amount of drug(s) necessary for therapy
- Reduction of side effects / damage to healthy tissues
- Multi-compartment structure may allow loading of drug “cocktails”
- Potential for drug targeting, further reducing side-effects
- Increase in time-release control
- Enhanced resistance to immune system



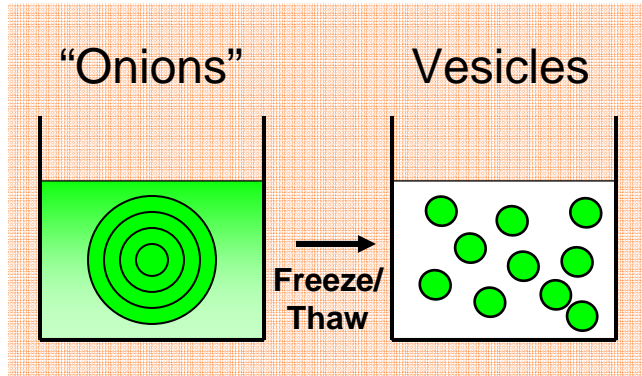
# Summer Research Goals

*Begin In Vivo Experimentation & Analysis*

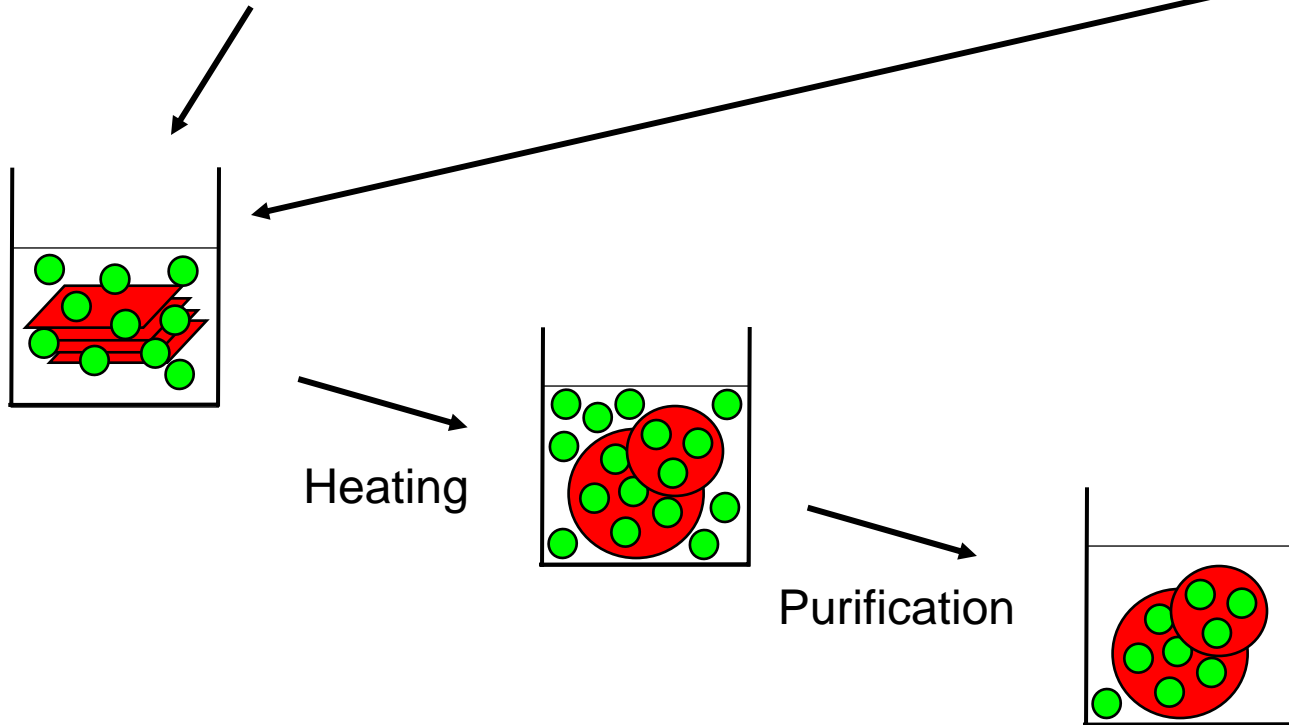
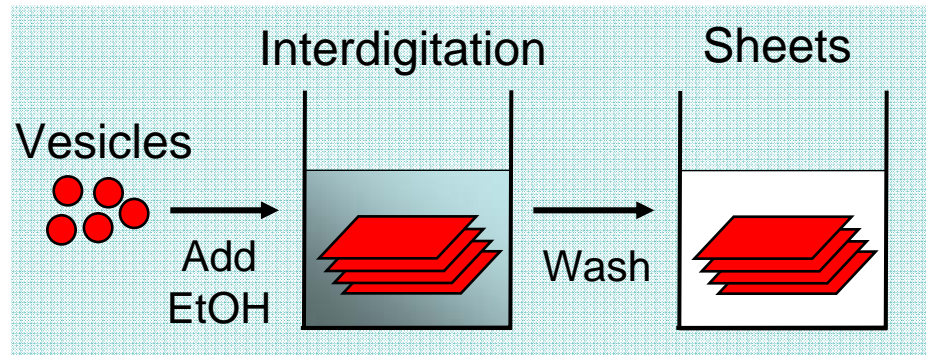


# Vesosome Production

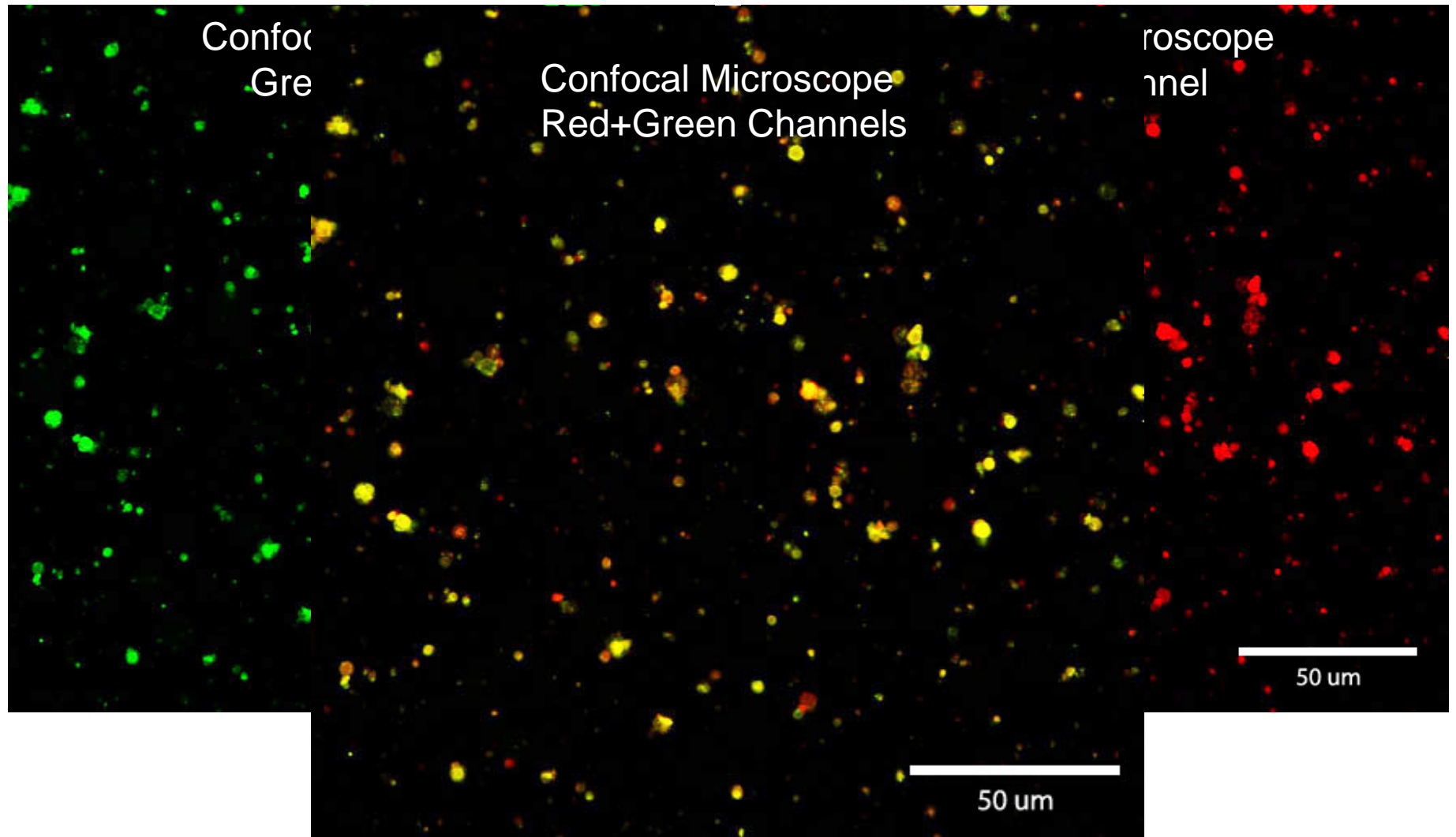
## Formation of Vesicles



## Formation of Sheets

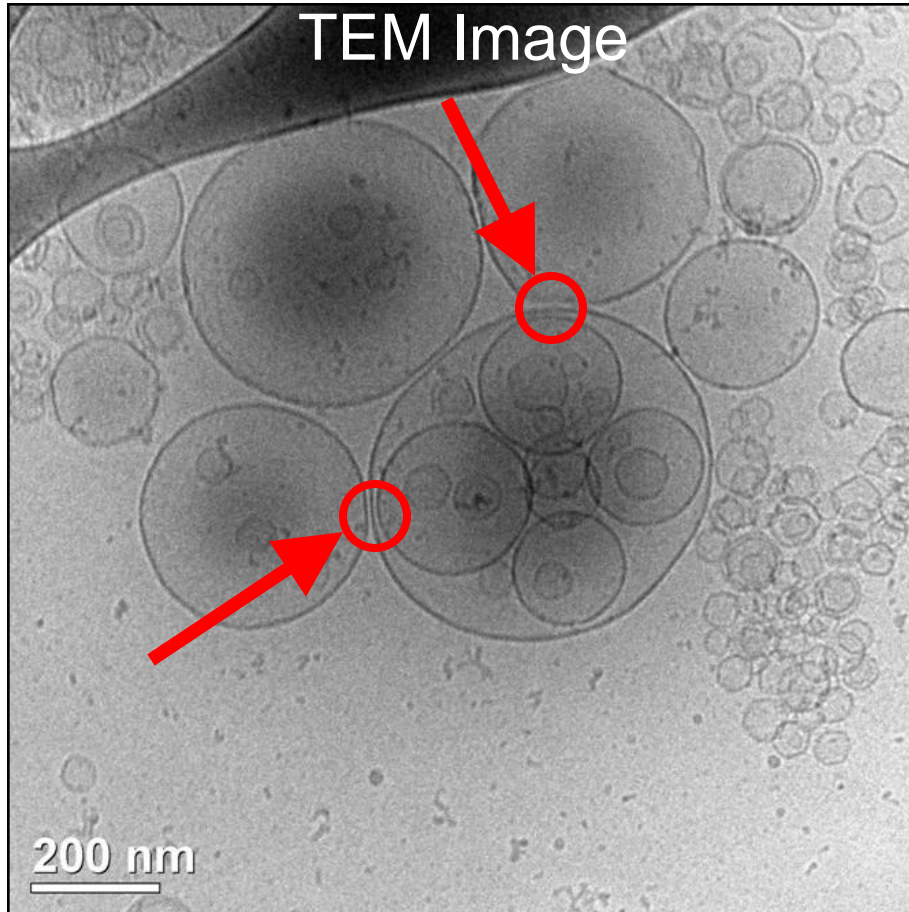


# Vesosomes In Buffer

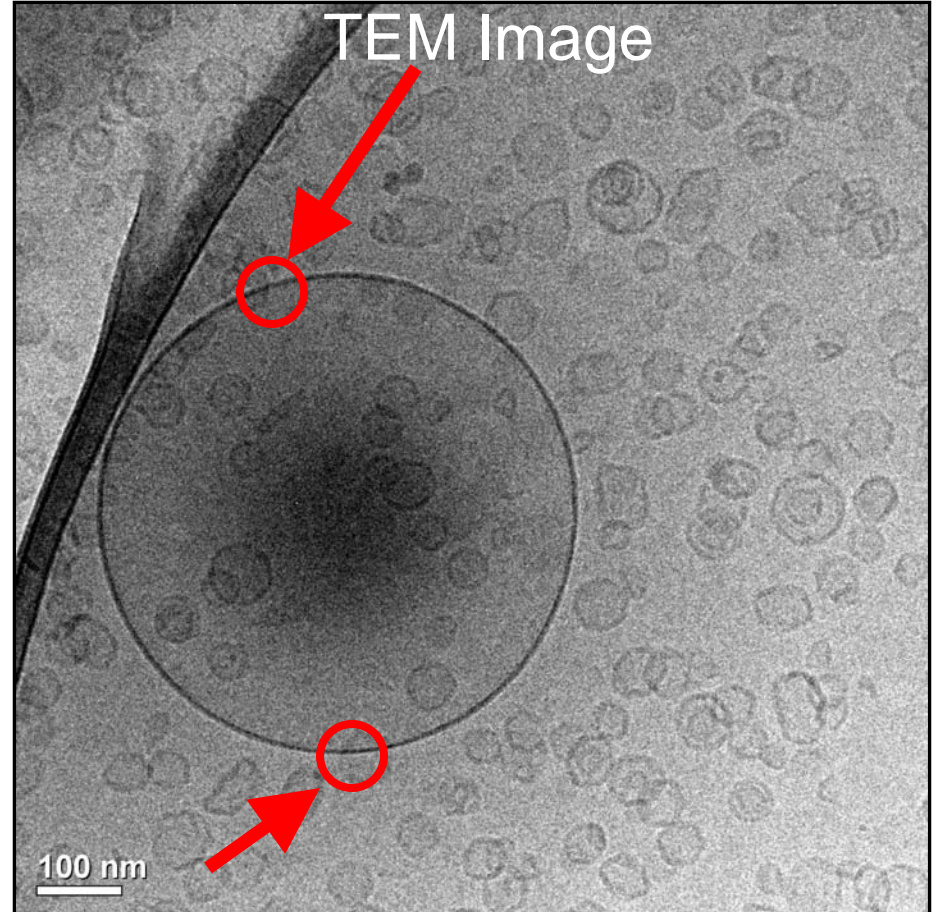


# Vesosomes In Buffer

Successful Encapsulation

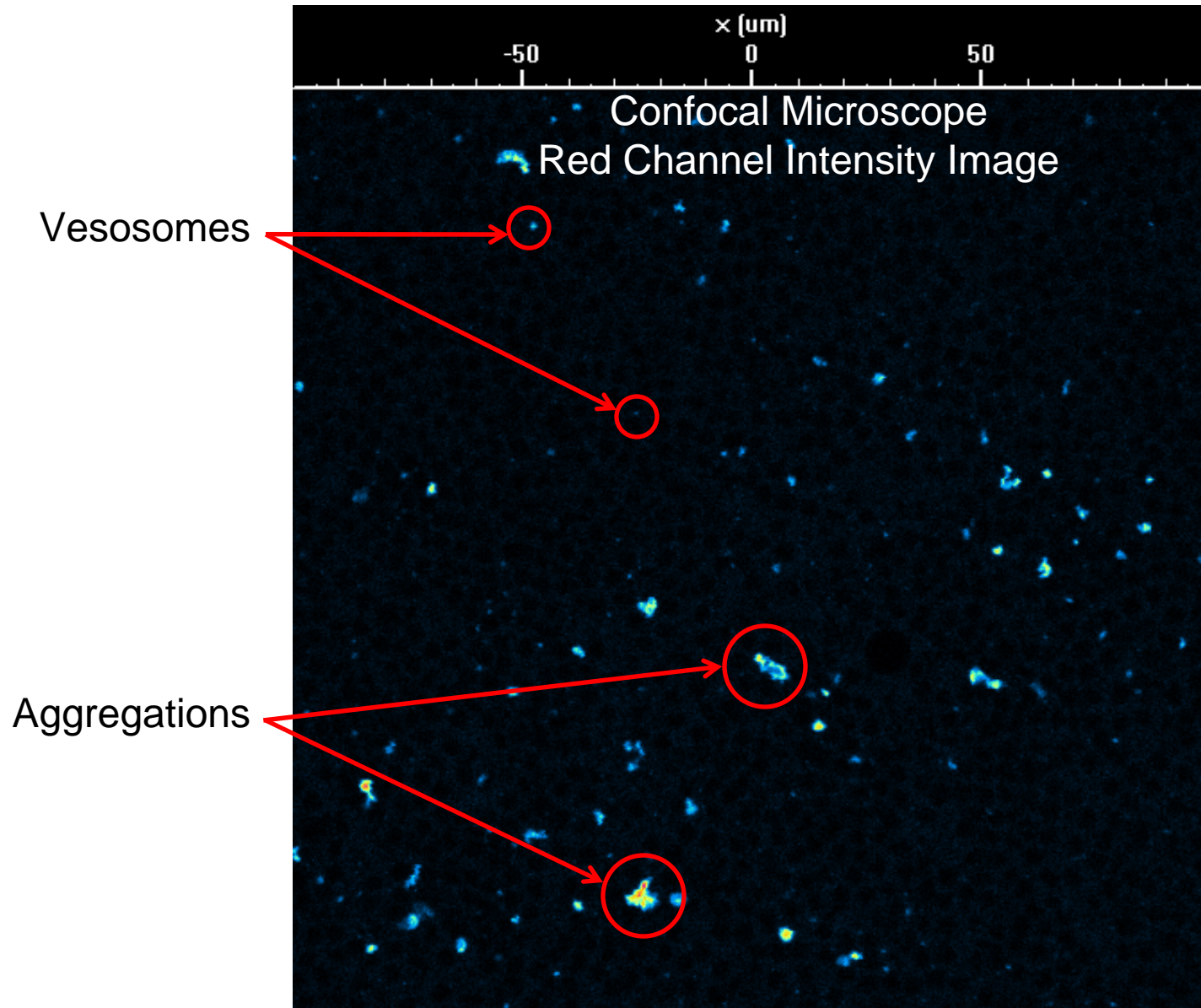


Unlikely Encapsulation



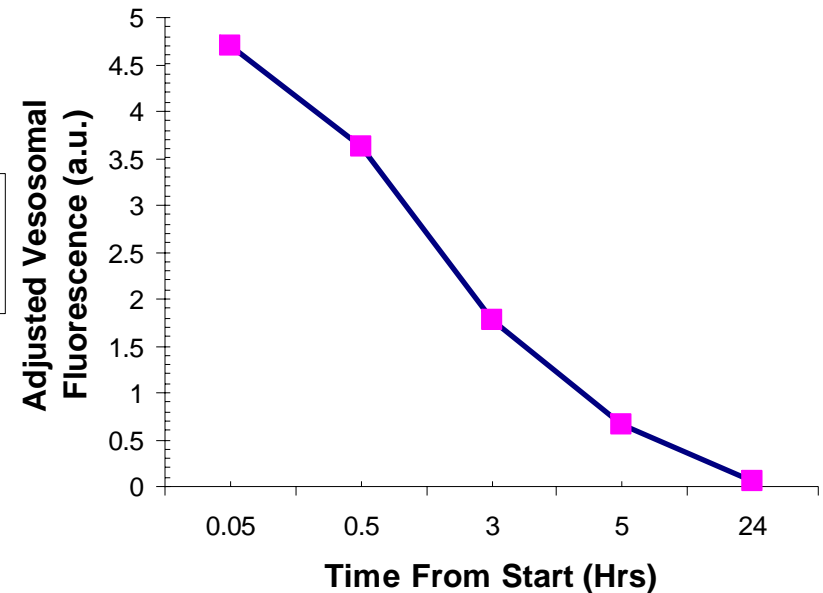
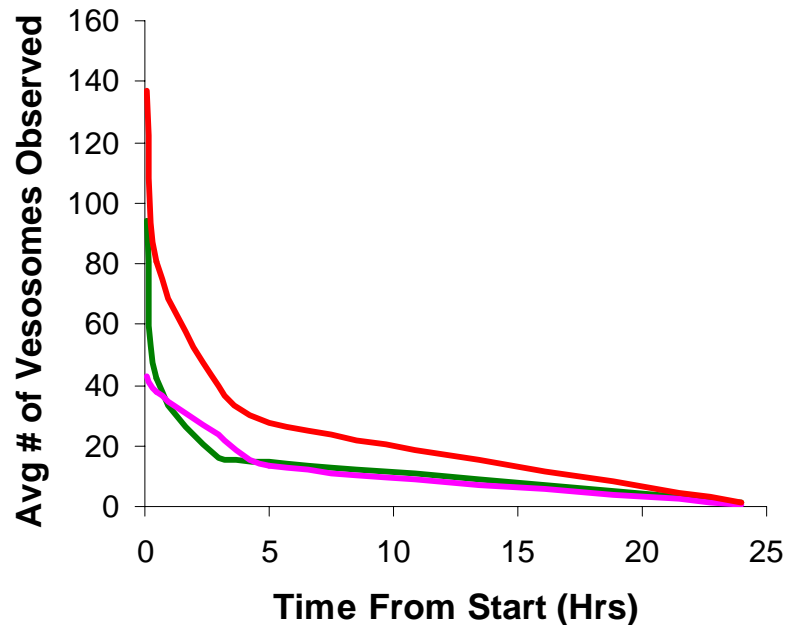
Cryo Transmission Electron Microscope Images

# Vesosomes In Vivo





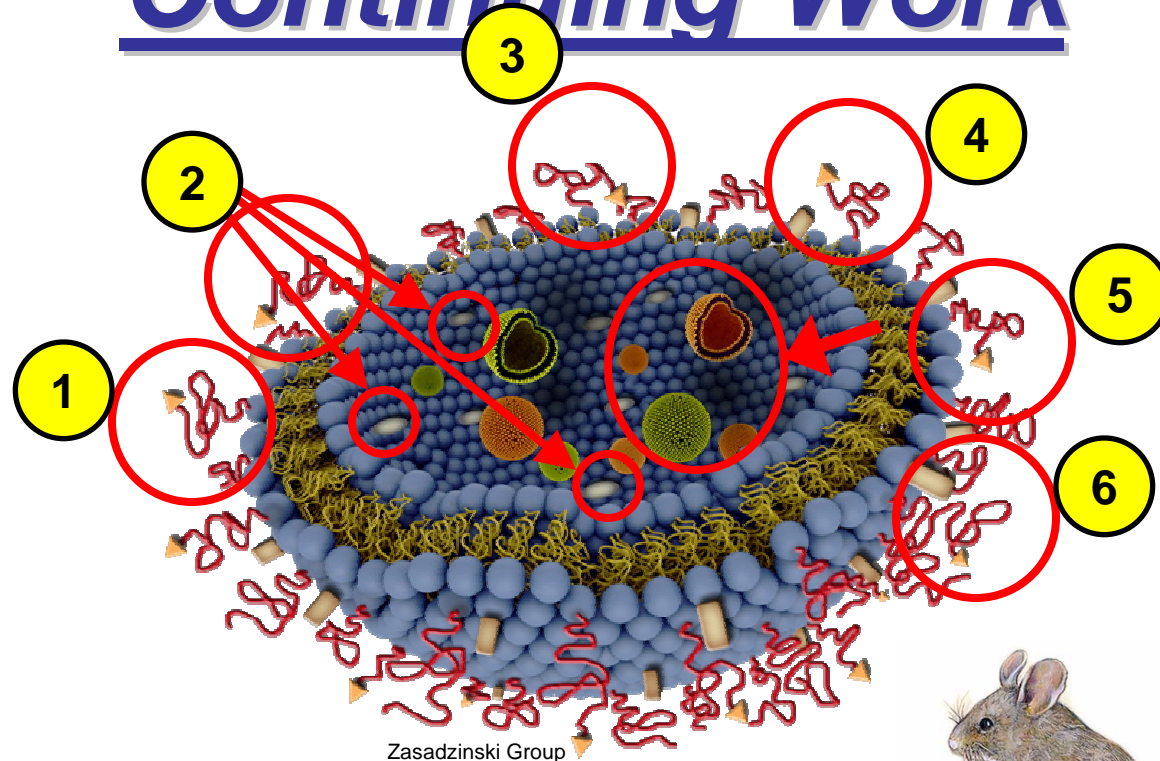
# Average Circulation Time of Vesosomes In Vivo



## Results:

- Overall half-life ~ 2hrs, which is shorter than expected
- Significant difference in half-life of single vs. aggregate vesosomes
- Vesosomes are aggregating in vivo

# Continuing Work



- Continuing In Vivo Experiments
- Refine Functionalization; Control Aggregation
- Quantification of Functionalization
- Encapsulation of *Multiple Different* Internal Components
- Incorporation of Channel Proteins Into External Bi-layer

# **Acknowledgements**

## **Internships in Nanosystems, Science, Engineering, and Technology (INSET)**

### **The Joseph Zasadzinski Molecular Engineering Group**

Ben Wong, Siggie Steltenkamp, Prajna Dhar, Ian Shieh,  
Patrick Seelheim, Patrick Stenger, Htet Khant

### **The Erkki Ruoslahti Group**

David Peters

