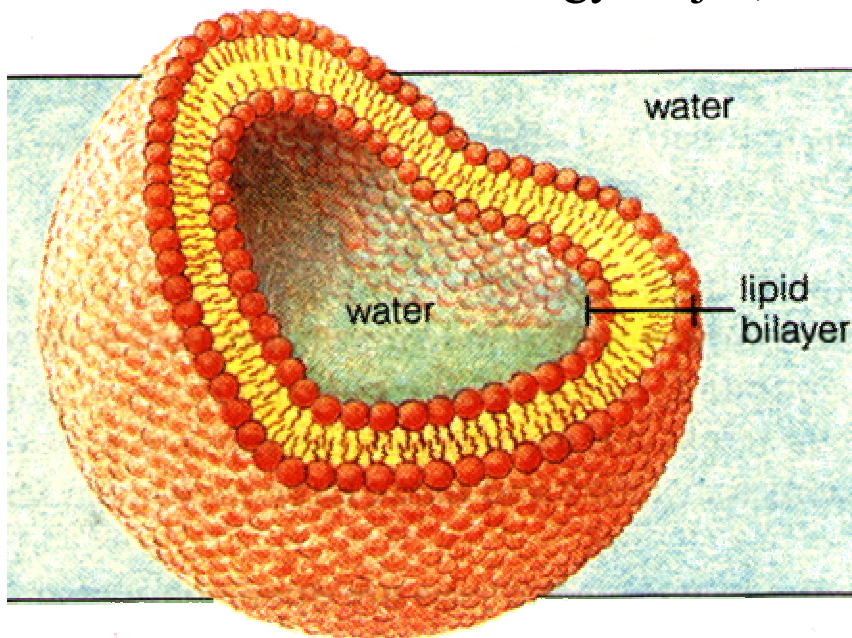


# Adsorption of Lipid Vesicles To Silica Surface

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<http://academic.brooklyn.cuny.edu/biology/bio4fv/page/phosphb.htm>

Mentor –

Travers Anderson

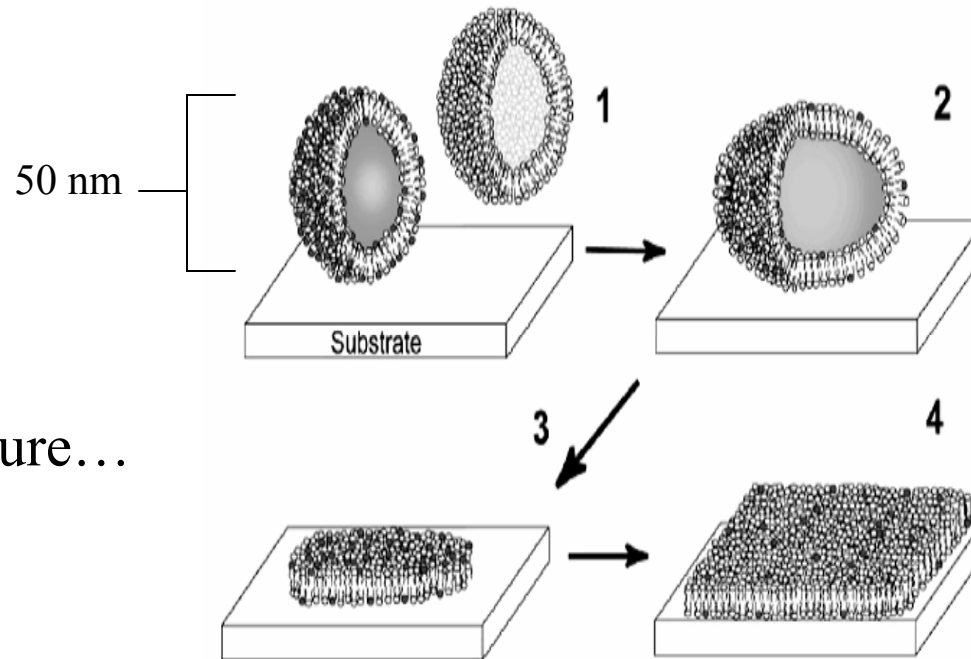
Faculty Advisor –

Jacob Israelachvili

Funded by – Corning Inc., Corning, NY

# Lipid Vesicles On Silica

Lipid vesicles adsorb...



...then rupture...

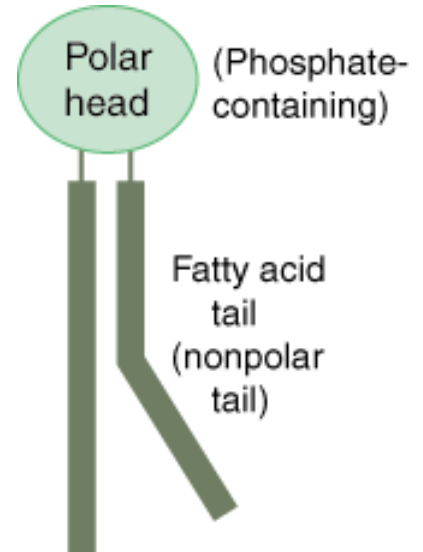
...creating bilayers supported on a substrate.

# Supported Lipid Bilayers

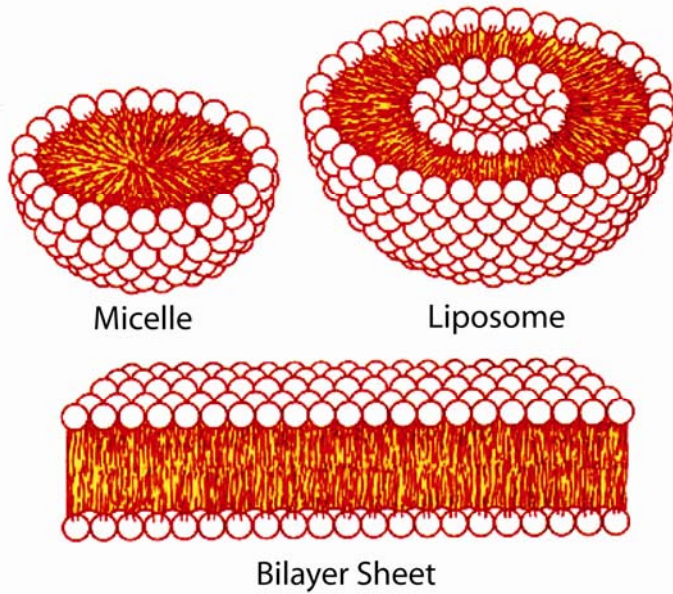
Applications and uses:

- Cell membrane models
  - To better understand actual cell membranes
- Biosensors
  - Portable, inexpensive devices to test for diseases in remote areas

# Creating Vesicles



- Lipids come in vials in chloroform
- Evaporate chloroform while rolling vial to create bilayer sheets



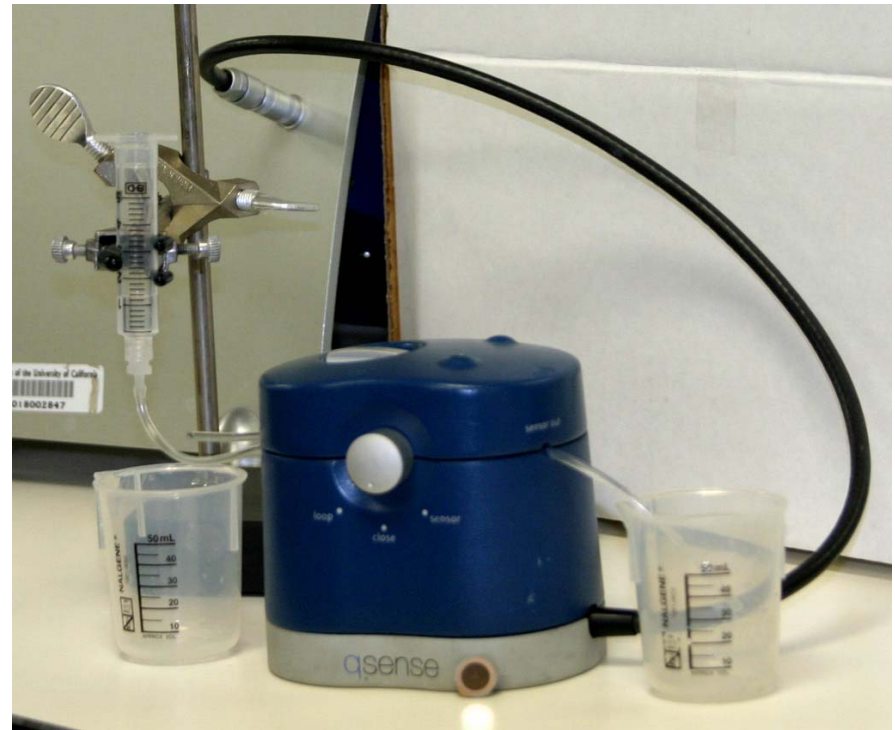
- Add buffered solution to vial
- Freeze/thaw to break sheets into vesicles
- Pass vesicle solution through extruder to break down vesicles to 50 nm.

# Adsorption Kinetics of Vesicles to Glass Surfaces

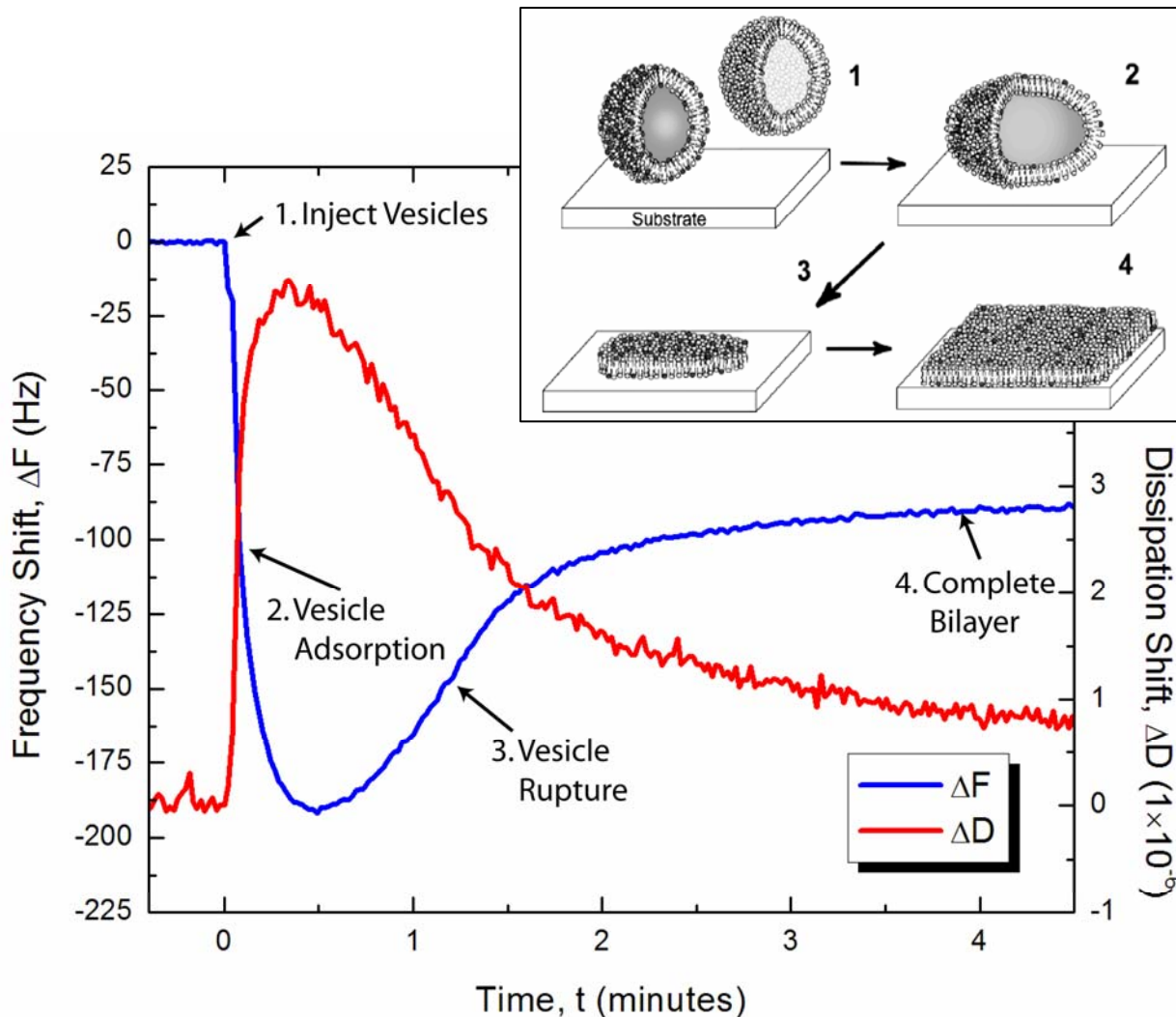
- Rate at which vesicles adsorb
- Variables that affect this process
  - Vesicle concentration
  - Salt concentration
  - Temperature
  - pH

**Quartz Crystal Microbalance  
(QCM)**

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# Quartz Crystal Microbalance (QCM)



## How it Works

- Quartz crystal vibrates as vesicles adsorb and then rupture
- QCM measures the frequency of the vibrations
- QCM measures the decay of oscillations of the quartz crystal

# Analyzing Results

## Sauerbrey Equation

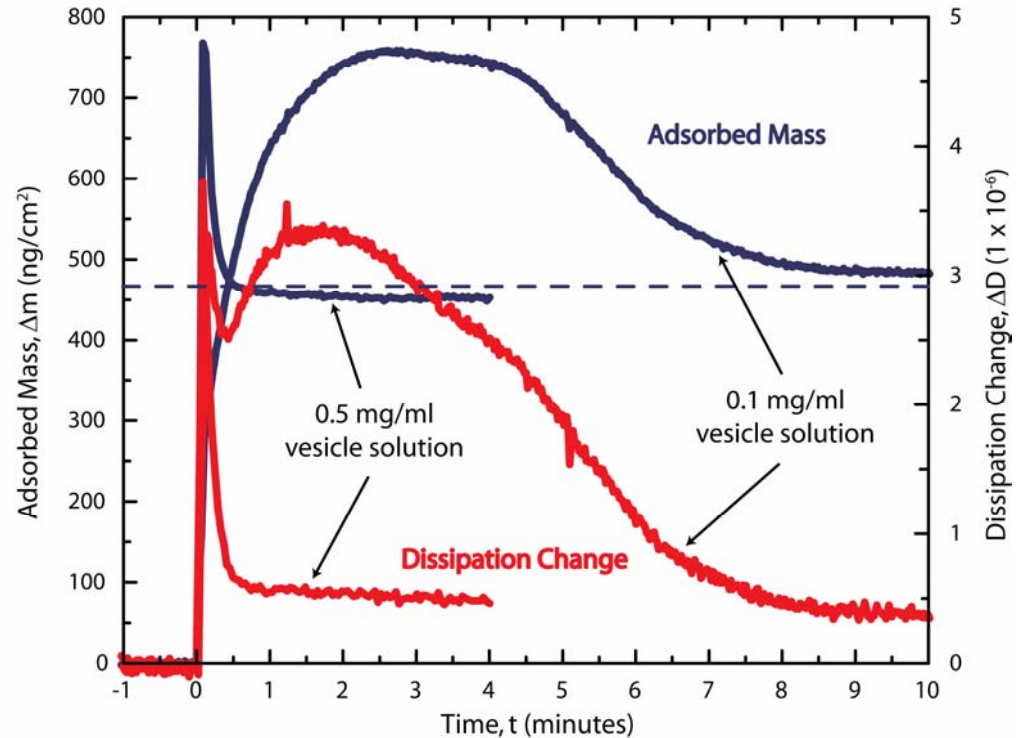
$$\Delta m = \frac{-C \Delta f}{n}$$

$\Delta m$ , adsorbed mass

$C$ , constant = 17.7 ng/Hz cm<sup>2</sup>

$\Delta f$ , frequency change

$n$ , overtone number = 3  
(Depends on the resonant frequency being measured at)



Experimental conditions:

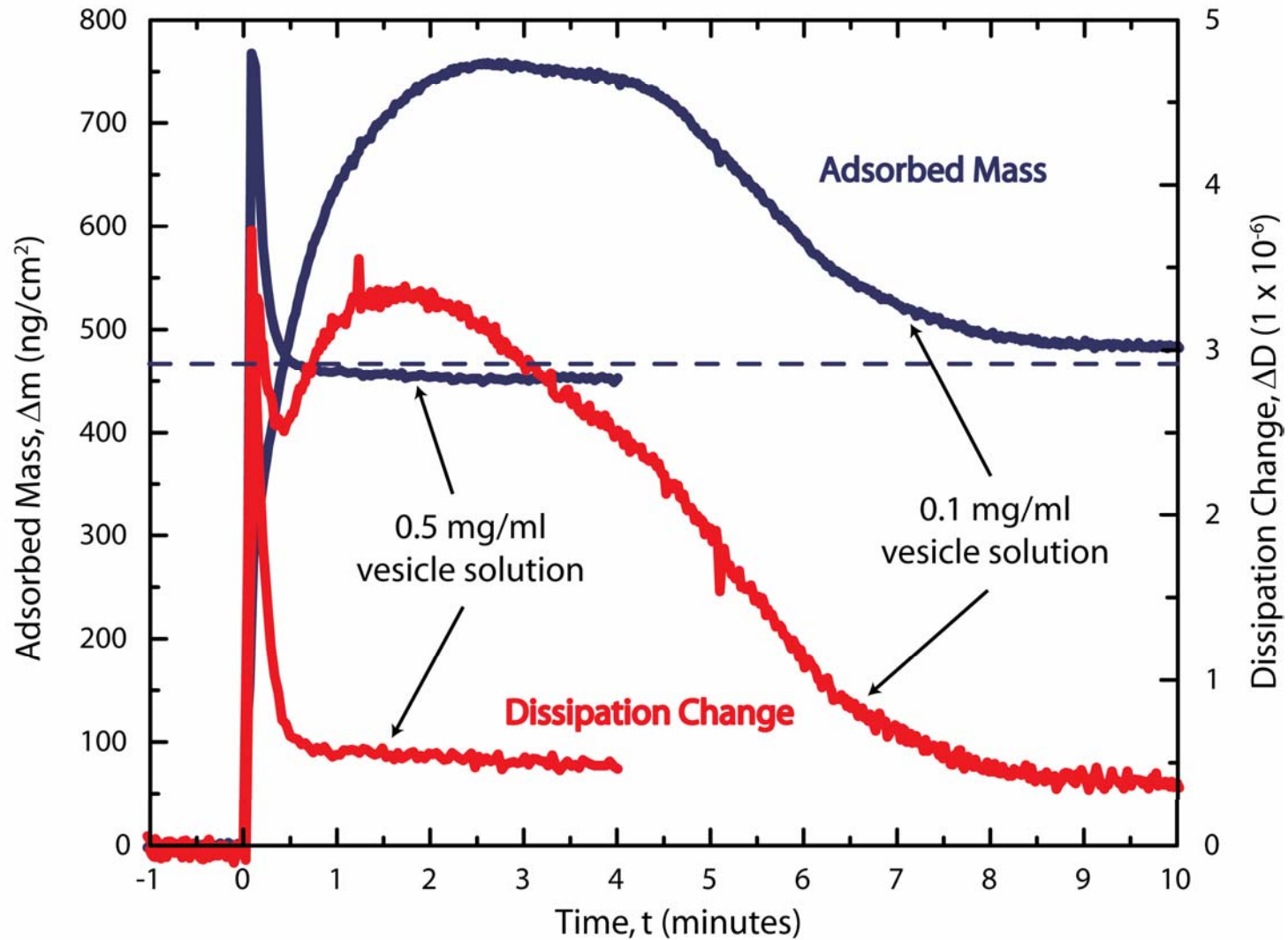
Temp:  
30°C

pH:  
7.4

Solution:  
PBS, 150 mM NaCl



# Analyzing Results





## What Remains to be Done

Continue running experiments with the QCM to determine the best adsorption rate of vesicles when in a solution varying in:

Temperature: 15 – 40°C

pH: 5 – 9

Salt concentration: 0 – 200mM



To determine the most efficient conditions to create supported lipid bilayers.

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