I. Abstract
Phosphatidylserine (PS) and monosialoganglioside (GM1) are examples of two host-derived lipids in the membrane of enveloped virus particles that are known to contribute to virus attachment, uptake, and ultimately dissemination. We learn the binding affinity of PS and GM1 lipid by using gold nanoparticle (GNP) since it is stable and conductive. Besides, changing concentration of lipid on the virus can control how the virus infective. The performed studies can use identify unknown concentration of lipid.

II. Introduction

1. Plasmonic nanoparticle

Applying light to plasmonic nanoparticle, it generates electromagnetic field. Therefore, it causes the electrons are moving back and forth. Those oscillation electrons (plasmons) give strong scattering cross section in resonance wavelength. In a situation where two plasmons are nearby, they can interact with one another. It is shown on spectrum as a red-shift, as seen in figure 2.

2. Virus Like Particle (VLP) and Liposomes

In VLP and Liposomes, there are two kind of lipids (PS and GM1) that are playing important role in infectivity. Phosphatidylserine (PS) has been shown to facilitate apoptotic mimicry and enhance glycoprotein-independent uptake of Vaccinia, Ebola, HIV, and Dengue viruses. Monosialoganglioside GM1 enable the glycoprotein-independent binding of HIV-1 particles to mature dendritic cells (mDCs).

III. Experimental Procedure

1. Liposomes-PS and Liposomes-GM1

PS in the liposome membrane are functionalized with biotinylated Annexin V (Anx). On the other hand, liposome membrane with GM1 lipid are functionalized with cholera toxin subunit B (CTB). Then, neutravidin is added to the solution. After neutravidin binds to the PS or GM1, the solutions are purified through dialysis for 48 hours.

2. 40 nm Gold Nanoparticle

Gold nanoparticles are prepared by adding single stranded DNA oligonucleotides Hs-AAAA AAAA AACTCAGCCTAC-GACTGAC ACC and Hs-AAAA AAAA AAAAGACTACACTAAGAAGCCTACTACAC AACCAGAGA-Biotin in a 4:1 ratio to 40 nm GNP. After sitting 30 min to allow DNA stick to the GNP, these particles are centrifuged for three times.

IV. Data/Results

1. Optical Measurement

Figure 5. UV-Vis spectra of different concentrations of (a) Liposomes-20% PS and (b) liposomes-10%GM1 mixed with 40 nm GNP at varying liposome:GNP ratios. These results of 3 runs of the experiment to indicated on which concentration of Liposomes-PS and GM1 give highest red shift. The dependence of plasmonic red-shift on the ratio of GNP : Liposome in specific binding of GNP to (c) 20% PS and (d) 10% GM1 lipid.

Figure 6. Calibration of the optical assay by liposomes for measuring GM1 concentration in virus-like particle.

V. Conclusions/Future Work

Based on the UV-Vis spectra, GM1 binding of GNP show a higher affinity than PS binding. Using this assay, we get up to 3 nm red-shift in case of 20% PS and up to 6 nm for 10% GM1 liposomes. The Reinhard lab plans to continue to research this and applying it on virus-like particles with unknown lipid compositions.

VI. Acknowledgements

- National Science Foundation
- Boston University
- Amin Feizpour
- Reinhard M Bjorn and laboratory members
- John Snyder and the BU REU program

VII. References