Functionalizing Nanodiscs with pH-Responsive Polymers

**Student Name**

Chinonso Opara

**Experiential Learning Category**

Research

**Associated UW Course (if applicable)**

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**Summary**

I am conducting a project with the departments of Bioengineering and Medicinal chemistry. I am attempting to incorporate the pH-responsive polymers, used for drug delivery and developed by the Stayton lab, into nanodiscs, which are synthetic membrane models used in the Atkins lab to characterize membrane proteins. This work would establish a baseline for advancing understanding of how the polymers interact with lipid membranes in order to further optimize them for drug delivery. In addition, functionalizing nanodiscs with the polymers could lead to a novel drug delivery vector. The nanodiscs would house and isolate the polymers from one another, potentially allowing for more efficient drug loading and delivery.

**Explain how your project fits the provided Honors Program definition of the Experiential Learning area you selected:**

I'll be using this project to fulfill the requirement for my departmental honors thesis. This would involve detailed literature review and collaboration between two different labs, in addition to designing experiments, interpreting data, and presenting results.

**How and why did you select this engagement?**

After my initial time with the Stayton lab working on a drug delivery project, I got the opportunity as an Amgen Scholar to get involved with the Atkins lab. There, I became fascinated with their nanodisc work. I saw an opportunity to establish collaboration between both labs, and this project gives me a way through which to do so. Since I am a link between both labs, I hope to improve my communication skills in order to encourage a positive collaborative environment, which would be necessary in my future career. I also hope to improve my research skills in terms of efficiently learning new techniques and reasoning out which steps to take next. This would also be beneficial in my future career.

**How does this project connect to your concurrent or past coursework? How does it speak to your broader education goals and experiences?**

This project ties into my biochemistry coursework in that the nanodiscs are modeled after high density lipoprotein (HDL) particles we learned about, which are used to shuffle cholesterol through the blood. This project allows me to explore further the concept of HDL particles in a different context. In addition, this project serves as a culmination of my undergraduate research experience, as I would devote part of my last year as an undergraduate to more deeply explore my interests in nanoparticles used for drug delivery. While my research experience has given me insight into what it takes to develop treatment for the clinic, I would also like to be involved in assessing the safety and efficacy of such treatments at the clinical level.

**How will your project contribute to the larger goals of the organization or those of your partners?**

The Atkins lab is a firm proponent of nurturing a dynamic collaborative environment. This aligns with their belief that a diverse group of individuals united via a common goal is a catalyst for progress and innovation. Due to the collaborative nature of my project, it fits well with the goals of the Atkins lab. The Stayton lab has developed the pH-responsive polymers used for drug delivery. As such, it is their aim to optimize design of the polymers in order to improve their drug delivery potential. My project addresses this aim.

**Estimated hours per week:**

10

**Estimated project start:**

10/01/2013

**Estimated project end:**

06/13/2014

Supervisor

**First name**

William

**Last name**

Atkins

**Title/Affiliation**

Professor of Medicinal Chemistry

**Organization (if applicable)**

Department of Medicinal Chemistry

**UW NetID (if applicable)**

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Final Reflection

**Project Title**

Functionalizing Nanodiscs with pH-Responsive Polymers

**Reflection**

I ended up changing my project halfway through winter quarter. My new project was also related to drug delivery.

The aim of my new project was to create HDL-like particles for potential use in drug delivery with a narrow size range. HDL helps to lower cholesterol by carrying cholesterol to the liver for excretion. While it fulfills this role in the body, in the lab, researchers are attempting to use HDL particles as drug delivery vehicles. However, methods of making HDL, involving the full length primary protein component, result in a solution of polydisperse particles. For an appreciation of this, imagine a golf ball and an exercise ball full of drug cargo. The difference in drug volume between these two confounds dosage precision. From this, it becomes more feasible to understand why drug delivery vehicles must be uniform in size.

In my project, by using a shorter version of the primary protein component of HDL, we were able to make HDL-like particles. Further analysis (from the electron microscopy images) suggested that the HDL-like particles come in a narrow size window. However, this will have to be confirmed through further analysis, such as by static light scattering or analytical ultracentrifugation.

In addition to serving as experiential learning for honors, I used this project as my senior thesis and for a publication in the McNair Journal. Most importantly, this project provided my lab with more ground work on preparing and analyzing the HDL-like particles for potential use as a drug delivery platform.

**Submitted on**

Jun 04, 2014