Optimization of Micelles for Therapeutic Delivery

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Introduction

Micelles are mainly used to deliver payloads for therapeutic or diagnostic applications. Some therapeutic applications that our lab focuses on is for the treatment of diseases such as Autosomal dominant Polycystic Kidney disease (ADPKD), glioblastoma, and kidney cancer.

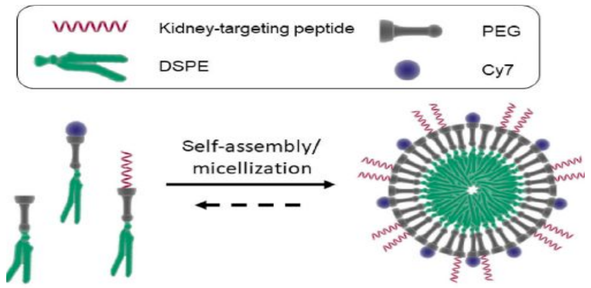

Figure 1. *Demonstrates the formulation of the micelles and how it is used for mRNA delivery*

With my mentors in the lab, I was able to develop and test micelles to determine their targeting abilities, and began loading them with a therapeutic to treat our targeted diseases.

Objectives & Impact of Research

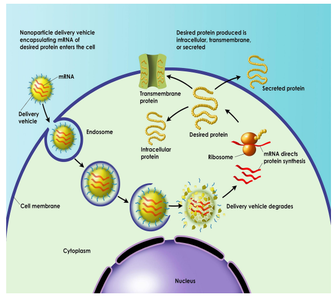

Figure 2. *Process of mRNA delivery*

The objective for Dr. Chung's Research lab is for the advancement of drug delivery using personalized medicine. The use of nanoparticles is a big part of her lab since they can be used to treat or regenerate diseased/ damaged tissues.

Methods and Results

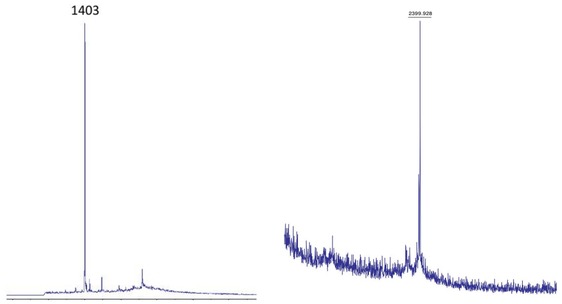

Figure 3. *Mass spectrometry data demonstrates successful synthesis of CD70-targeting peptide (left) and IL13αD (glioblastoma-targeting) peptide (right). Photo credits: Noah Trac (left), Abby Lim (right)*

DSPE-PEG-IL13αD	13.73 +/- 1.01	9.08 +/- 1.06
DSPE-PEG methoxy (Non-Targeting)	16.23 +/- 4.76	0.07 +/- 0.26

Figure 4. *Characterization of size and charge (Zeta potential) of micelles through DLS (dynamic light scattering) Photo credit: Abby Lim*

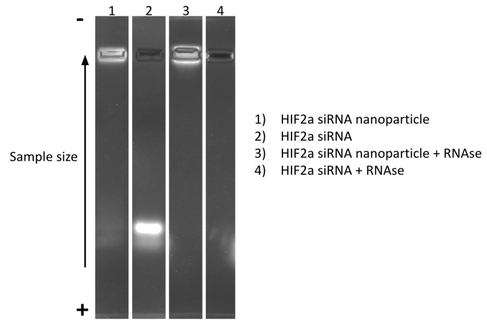

Figure 5. *Gel electrophoresis allows us to detect whether or not the siRNA therapy has been implemented into the nanoparticles. If it moves down the gel, it means the siRNA was not incorporated well into the nanoparticle. If it remains in the nanoparticle, it will remain at the top of the gel. Photo credit: Noah Trac*

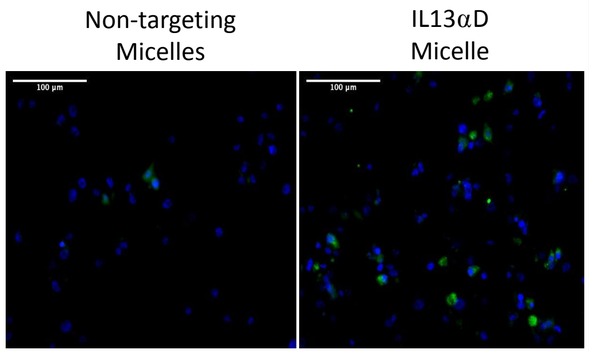

Figure 6. *Micelle binding of the GBM targeting peptide IL13aD (green) is shown to effectively bind to cells in comparison to the non-targeting micelles. Photo credit: Abby Lim*

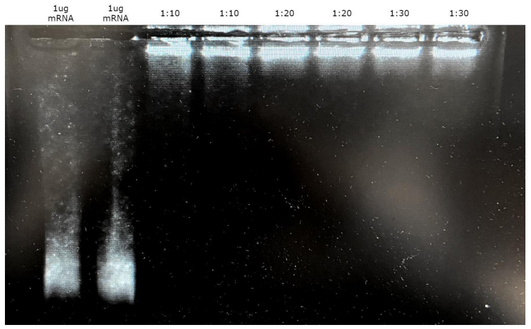

Figure 7. *Gel Retardation Assay Results shows the 1:10 weight ratio seems to adsorb mRNA which doesn't allow it to freely travel down the gel Photo credit: Alysia Cox*

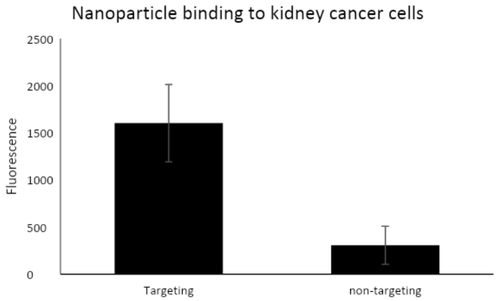

Figure 8. The graph illustrates that the nanoparticle was able to bind to the targeted cells more than the non-targeting cells, which shows efficiency. Photo Credit: Noah Trac

Advice for Future SHINE students

Some advice I would give for future SHINE students, is to be outgoing on meeting as many new people as you can during this experience. You are going to meet so many people during the program that can give you really great advice about college and your future STEM journey. The best thing to do is ask them questions about their own experiences so that it can help influence your future career decisions to see if this field is what you want to do for the rest of your life. They really do not mind you asking question about their journey in STEM or even things about themselves; in fact, they actually encourage it.

Acknowledgements

I would to thank Dr. Chung for giving me the opportunity to be in her biomedical lab with my mentors Alysia, Abby, and Noah who have really given a great insight into the college and lab life experience. I will always remember my mentors advice and use it all the way through my STEM journey. I would also like to thank SHINE and AMI-USC for granting me a full scholarship into the SHINE program, allowing me to explore and use many things that SHINE was able to offer.