NK Cell-Derived Extracellular Vesicles as Potential Antiviral Nanomaterials

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Introduction

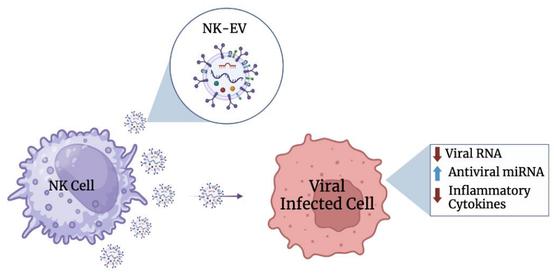

Figure 1. NK-EV Antiviral Potential

- Natural Killer Cells (NK Cells) are in the lymphoid cell family, and aid in killing and detecting diseased cells.
- NK cells release Natural Killer Cell-Derived Extracellular Vesicles (NK-EVs) into extracellular spaces.
- NK-EVs hone over and will bind to virally infected cells using their receptors, destroying the cell.

Objective & Impact of Professor's Research

- The Chung Lab's research focuses on the development of targeted nanoparticles to improve drug delivery.
- One of the main focuses of the Chung Lab involves the harnessing and upscaling of the therapeutic and targeting ability of endogenous nanoparticles (EVs).
- NK-EVs act as endogenous nanoparticles with unique immunomodulatory properties and have the potential to inhibit viral infection through their cargo.
- To demonstrate NK-EVs as potential antiviral nanomaterials, we used SARS-CoV-2-infected mice as a model.

Methods and Skills Learned

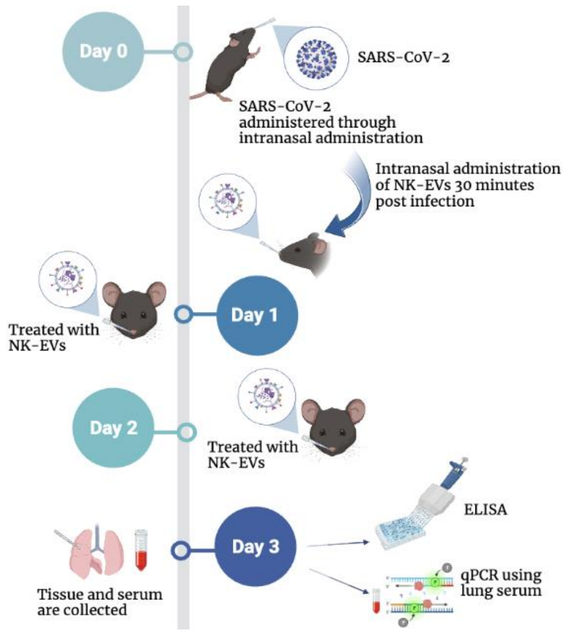

Figure 2. SARS-CoV-2 In Vivo Experimental Scheme :We treated SARS-CoV-2 infected mice with NK-EVs intranasally once a day. At day 3 post infection, mice were euthanized, and tissue and serum were collected.

ELISA (Enzyme-Linked Immunosorbent Assay)

- I learned to how to wash ELISA plates, which is used to measure protein concentration.
- We used ELISA to measure the proinflammatory cytokines TNFa and IL-8.
- I also learned the techniques for culturing lung cells such as pipetting and aspirating cell media, detaching cells with trypsin, and cell counting.

qPCR (quantitative Polymerase Chain Reaction)

- I learned how to analyze qPCR data using the delta-delta Cq method, which is used to quantify gene expression.
- We used qPCR to measure the proinflammatory cytokine IL-8, KI67 (cell proliferative marker), caspase 3 (apoptosis marker), and viral RNA.

Results

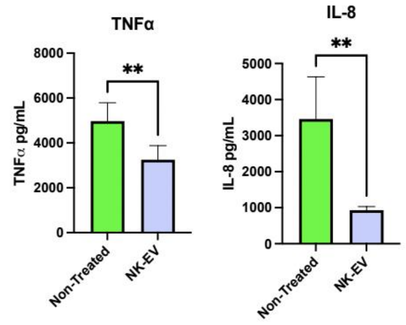

*Figure 3. ELISA Quantification of lung homogenate. NK-EV treated mice demonstrated lower concentration of the TNFa and IL-8 in lung homogenate. n=3, ** p<0.01 PC: Abby Lim*

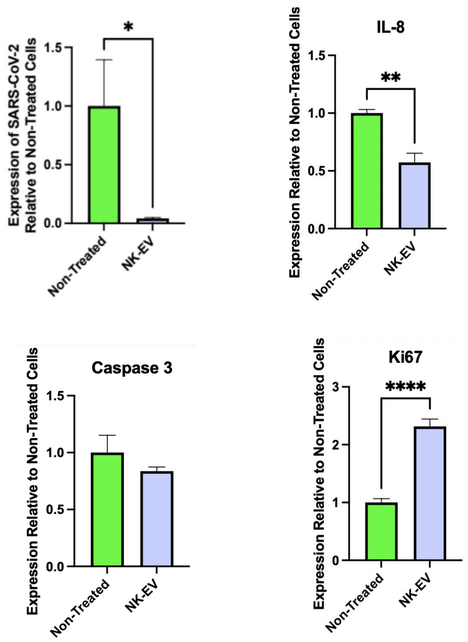

*Figure 4. qPCR Quantification of lung homogenate. NK-EV treated mice showed reduced expression of viral RNA, IL-8 and caspase 3 along with increased expression of Ki67. n=3, * p<0.05, ** p<0.01, **** p<0.0001. PC: Abby Lim*

Next Steps for You & Advice to Future SHINE participants

The Chung Lab has deepened my interest in the field of biomedical engineering and biomedical-related research. I'm considering pursuing it as a future career in college along with a Ph.D.

Advice:

- Please take advantage of all that SHINE has to offer you, connect with your mentors (Ph.D. and sub-cohort), connect with other SHINE students, and ask questions if you're ever stuck or confused.
- Remember that you deserve to be here and to have fun!

Acknowledgements

I would like to express my gratitude to Dr. Chung for allowing me to work in her lab and thank my mentor Abby as she helped guide me through the many procedures. She was very patient with me through the program and explained the concepts in a way I could understand. I'm also grateful for my parents as they committed to driving me to this program and believing in me. Lastly, I would like to thank SHINE Director Monica Lopez and SHINE Co-Director Dr. Darin Gray for granting me this opportunity and the USC-Meta Center for a full-ride scholarship. The support I received throughout SHINE has been invaluable in crafting my understanding of biomedical engineering and fueling my passion for STEM research.

USC-Meta Center for Research and Education in AI and Learning

Citations

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