

NDnano Summer Undergraduate Research 2025 Project Summary

1. Student name & home university: Hetvi Patel, University of Notre Dame
2. ND faculty name & department: Dr. Meenal Datta and Dr. Ryan Roeder, Aerospace and Mechanical Engineering (AME)
3. Summer project title: Nanoparticle-mediated reprogramming of cells to fight cancer
4. Briefly describe new skills you acquired during your summer research:

- Cell culture
- RNA extraction and PCR
- Immunofluorescence staining
- Fluorescence microscopy
- Glove box operation
- Nanoparticle synthesis

5. Briefly share a practical application/end use of your research:

The goal of this project is to use fluorescently-labeled silica nanoparticles (SiO₂-RITC NPs) to target and reprogram cancer-associated fibroblasts (CAFs) into a tumor-restraining state.

6. 50- to 75-word abstract of your project:

Fibroblasts play critical roles in the tumor microenvironment (TME), potentially contributing to cancer progression and resistance to therapy. To explore fibroblast-specific targeting strategies. We developed rhodamine-labeled silica nanoparticles conjugated with the antibody to PDGFR α . Uptake was assessed in murine NIH3T3 fibroblasts and RAW264.7 macrophages using fluorescence microscopy in co-culture, and cytotoxicity was evaluated with viability staining. This work establishes a proof-of-concept platform for antibody-mediated nanoparticle delivery to fibroblasts, enabling future studies in targeting and reprogramming these cells.

7. References for papers, posters, or presentations of your research:

1. Plikus, M. V. et al. Fibroblasts: origins, definitions, and functions in health and disease. Cell. 2021. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8566693/>
2. Stöber W. et al. Controlled Growth of Monodisperse Silica Spheres in the Micron Size Range. Journal Of Colloid And Interface Science (1968). http://www.ipfdd.info/fileadmin/user_upload/mbz/lectures/Microsystems/Stoeber1968.pdf
3. Tsoumakidou M. The advent of immune stimulating CAFs in cancer. Nature Reviews Cancer (2023). <https://www.nature.com/articles/s41568-023-00549-7>