

Reflections on My Caltech SURF Experience

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In the summer of 2025, I had the precious opportunity to conduct a 10-week research project at Caltech, one of the most prestigious colleges in the world, known for having the highest density of Nobel Prize laureates. During the summer, I worked on a proteomics-based study under the guidance of Professor Tsui-Fen Chou.

The primary goal of my project was to investigate the resistance mechanisms of mutant HCT116 cell lines to p97 inhibitors, CB-5083 and CB-5339, using both single-cell and bulk proteomics. Professor Tsui-Fen Chou leads the Proteome Exploration Laboratory (PEL) at Caltech, which conducts cutting-edge research in mass spectrometry-based proteomics and collaborates with scientists from various fields including biology, chemistry, geosciences, and engineering. At PEL, I had the valuable opportunity to learn from my mentor, Marion, how to operate Thermo Scientific's Astral, one of the most advanced mass spectrometers available.

My mentor is also an expert in single-cell proteomics (SCP), a technique that analyzes proteins within individual cells to reveal cellular heterogeneity that bulk analysis cannot capture. During my internship, I gained hands-on experience in the complete SCP workflow, including sample preparation, instrument operation, and data analysis using bioinformatics tools such as DIA-NN and Proteome Discoverer.



I also learned proper cell culture techniques during the summer. Although tissue culture may seem routine, I realized how personal lab habits play a crucial role in preventing contamination. I spent a large amount of time culturing and passaging three mutant HCT116 cell lines that are resistant to p97 inhibitors.

Looking back on these ten weeks, I've come to appreciate that the value of this experience lies not only in the experiments themselves, but also in learning how to collaborate effectively, communicate clearly, and stay resilient in the face of unexpected challenges. There were times when things didn't go as planned. For example, the PEL experienced a power outage that shut down all mass spectrometry instruments for two weeks. However, working with my graduate student mentor, Marion Pang, and other senior lab members taught me how to approach setbacks with a positive attitude. Their encouragement reminded me that the process of learning and problem-solving is just as important as the final outcomes.

Caltech also provided SURF students with a variety of helpful seminars. For example, the Caltech admissions committee shared insights into what they value in PhD applications, the Caltech Writing Center offered guidance on crafting strong personal statements, and faculty members gave presentations on their research. I also had the privilege of attending a faculty-student dinner, where I was able to speak with professors about their work, academic paths, and advice for the future.

Outside of the lab, I enjoyed exploring Los Angeles with other NTU-SURF students. We visited Santa Monica to enjoy the sunshine and the incredible Pacific Ocean views, and we went to Hollywood to see filming locations and the Walk of Fame. Marion also showed me a different side of LA by taking me to a Lady Gaga concert and a baseball game at Dodger Stadium where we watched Shohei Ohtani play. I'm also very grateful to Mrs. Oyang, who kindly took us to Long Beach and treated us to a delicious meal.



Caltech is also known for its astrophysics and planetary science programs and manages NASA's Jet Propulsion Laboratory (JPL). Although I didn't have the chance to visit JPL, I really enjoyed the events hosted by Caltech Astronomy. One of the most memorable was "Astronomy on Tap," a public science event held at a nearby restaurant where PhD students gave talks on their research, including simulations of black hole mergers. These talks were open to everyone and drew a wide audience, from elementary school students to Caltech faculty. I also joined Caltech graduate students on a trip to Mount Wilson Observatory for stargazing, which was a truly memorable experience.

Last but not least, I would like to thank Mrs. Oyang, the NTU Office of International Affairs, and the Caltech Student-Faculty Program for making this experience possible. This was my first time conducting research in the United States, and I am genuinely grateful for everything I learned and experienced this summer.

