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### ***Meaning of Nakatani RIES Fellowship:***

The Nakatani RIES Fellowship means much more than just doing research in a foreign setting. To me, this program has been an immersive and enriching experience that allowed me to experience Japanese culture in a unique way. Not only was I able to travel to many beautiful destinations and try delicious foods, but I was also able to live on my own to experience the daily life and commute in Japan. In addition, I was able to experience a superb weekend trip coordinated by the group that gave me the opportunity to experience new cities that I would not have found on my own. Truly this experience was the perfect combination of a cultural and academic program that challenged me with research while allowing me to enjoy the beauty of Japan.

### ***Research Internship Overview:***

To summarize, the purpose of my research project was to investigate the properties of fluorescent nanodiamonds (FNDs) as a temperature sensor through measuring temperature flow change inside of a polydimethylsiloxane (PDMS) microfluidic device. To do this we inserted the FNDs in a microfluidic device on the PDMS and slightly under the PDMS after it was transferred from silicon. Using these two positionings of FNDs, I created a testing procedure that used pressure controllers to flow hot and room temperature water into a microfluidic flow channel with the diamonds and measured the temperature of the laminar flow with their fluorescence with a thermocouple for comparison. The project required Multiphysics simulations, polymer creation, sample preparation, 3D computer-assisted design modeling, 3D-printing, pressure controller automation, and fluorescent microscopy. Throughout my experience at the lab, I had to learn almost everything from my mentor because I did not have previous experience with this kind of polymer preparation and microfluidics. In addition, many of the processes to prepare samples for testing require multiple steps that involve multiple hours of waiting. As a result, progress was a little slow and I consistently had to plan my actions with waiting time in mind so I could minimize the amount of time I wasted. My mentor, Saikawa-san, was always patient with me and helped me learn from my mistakes as I made them. Overall, I learned a lot of new skills at this lab, and it helped provide me with different perspectives on research.

This project is related to my future academic interests because I plan on doing some sort of tissue or biomechanics engineering related research. This project dealt with completely new topics to me and allowed me to gain insight on more sectors within biomedical engineering research. It has given me a newfound interest in microfluidics, and I might want to pursue body-on-a-chip related projects in the future (as I have seen how promising they can be). Working in an international setting was interesting but overall similar to research in the US with a few cultural differences. One of the biggest differences was the removal of shoes when

entering the office space and putting on different shoes when entering the lab space. I will take away my knowledge of microfluidics and polymer construction and possibly apply it to future research projects as I continue my academic career.

### ***Lab Environment Overview:***

The personal lab environment at the Hirai Lab was generally very pleasant and inviting. The lab itself is small, with fewer than ten main lab members. I was fortunate that my mentor, Keita Saikawa, and Hirai-sensei were able to communicate with me well in English. Many of the other members could communicate a limited amount in English but I still had a positive relationship with them. They all usually worked independently on whatever project they would be working on, and we would all get together for weekly team meetings to update on our progress. The main source of communication in the lab was the Slack group. In general, the working style of the lab was independent followed by updating everyone else on your work. My mentor usually planned out his work in detail before executing it. The working style is like my lab in the United States except for the fact that Hirai-sensei was very diligent about the work of the lab members and provided a lot of feedback on work. Usually at my US lab, my PI almost never interacts with the undergraduate students due to how busy he is with other projects. Overall, I had a pleasant experience with working at the lab despite the language barrier.

### ***Daily Life in Japan:***

My daily life in Japan was generally pleasant and provided with me with a unique experience compared to my life in the US. I was provided with a single apartment with a kitchen, bathroom, and general room with a bed and table, as well as a small patio. The apartment was nice and gave me the option to cook without having to buy too many additional things and came with a laundry machine as well. On a usual day, I would get ready in my apartment, walk to the bus stop, take the bus to campus, spend the day at the lab, take the bus home, pick up dinner, and spend the rest of the night in. For food, I only cooked once because the money provided to us was more than enough to buy us a hearty meal at a restaurant. Meals in Japan are generally much cheaper than in the US, so this allowed me to save time on cooking and try new foods at different restaurants. Sometimes after lab, I would go to different places around Kyoto like Kyoto-kawaramachi and walk around for a while. Besides my lab members, I usually did not talk to too many people besides my limited interactions with service workers. In addition to cheaper meals at restaurants, the convenience stores scattered throughout the city were a big part of my experience in Japan. I would frequent the stores at least once a day for a snack or water for my apartment. On weekends I would always try to visit a new place in Japan, whether it be a new city or a new place in Kyoto I had not visited. The train and bus system throughout the country makes it incredibly easy to travel to different places with the help of Google Maps. I would either travel alone or with other Nakatani fellows. The main challenges I experienced this summer were the extremely hot and humid conditions as well as laundry. The hot and humid conditions made hydration and cooling wipes essential while traveling. The only problem with laundry was that after washing my clothes, I had to hang my clothes to dry and oftentimes it would rain outside so they would have to dry for days in my apartment. But overall, my daily life in Japan was pleasant and unique to how I usually go about my day in Atlanta.

### ***Experiences with Japanese Culture:***

Japan has provided me with many meaningful experiences while I was there. The program itself provided many weekend trips that not only allowed me to see many beautiful landscapes but also try many different foods in cultural settings. One of my favorite experiences was eating a feast of different seafood at the Osatsu Ama Hut. The food was fresh right from the sea and prepared for us on a charcoal grill as we learned more about the “Ama” divers that day. Another cultural experience I enjoyed was staying at a more traditional Japanese style hotel in Toba where I wore a yukata, ate more delicious food, slept on a futon on a tatami mat, and tried an onsen. These are just a few examples, but it was experiences like this that helped me enjoy aspects of Japanese life I did not experience too often. To celebrate my arrival, we had a few parties while I was at Kyoto University. One of the parties was a Takoyaki party in which we sat and grilled Takoyaki and ate cold soba noodles. This was an experience that helped me try new Japanese foods with my lab members. In addition, one aspect of Japanese culture that my lab members taught me was that meals (specifically lunch) are eaten quickly and efficiently so that we could get back to work. To build on that, throughout this trip I had eaten almost every meal with chopsticks to practice my form. In daily life, I would usually eat some sort of rice dish with meat or sushi for dinner. In addition, when going on any public transportation such as the train or bus, everyone was generally very silent and did not eat or drink anything. This cultural difference between US and Japan in this respect is quite dramatic. These experiences as a whole taught me that Japan has an exquisite variety of foods, works with speed and efficiency, and has a culture of general respect for others. This taught me that I appreciate these qualities in a country and that I will try my best to emulate some of the cultural differences in my country.