

Final Internship Report

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At a glance

I spent three months working in Dr. Roberto Amici's lab at the Università di Bologna, in Bologna, Italy. I worked alongside thesis, Master's, and Ph.D. students on projects related to sleep and the effects of inducing a torpor state in non-hibernating animals. The majority of my work was done in assisting with rat surgeries and sleep deprivation experiments. Living in Bologna requires a strong knowledge of the Italian language as few people speak English outside the lab, and working in the lab it is beneficial as well as most people default to Italian when speaking to one another. Working in an Italian lab is very different than a U.S. lab, as supplies are often made in the lab and limited at best. I was working on research at the forefront of science, but with tools that have not been used in the U.S. for decades. I learned not only how to be more frugal with lab equipment, but also how to construct what tools we needed out of the supplies we had instead of relying on the ability to just buy whatever we needed.

Overview of the Internship

The Università di Bologna is considered to be the first university in the western world, however this historic institution has its eyes very much focused on the future. The Università di Bologna's mission is to inspire innovation in its students and faculty, as it remains at the forefront of teaching and research in Italy. A large component of this mission is to maintain and expand collaboration between institutions around the world. I witnessed this as I met with guests to the university and students from the Netherlands, Canada, Croatia, China, and all regions of Italy. Working in such a collaborative environment was thrilling, as my work was not confined to the boundaries of my department. I received insights from people working in various fields related to my lab's research, and also enjoyed just gaining varying cultural perspectives from people of various backgrounds. This collaborative focus may also be the origin of the heightened value of compassion at the university. Whether someone is ill or prepping for a tough exam, everyone works together to give the individual in-need all the support they could ever ask for. The people you work with are your family, and although teasing and badgering are common, everyone looks after each other in a way that keeps the team going without sacrificing the well being of the components that make it up.

Projects + Types of Work

During my stay in Bologna I worked on a couple of projects. At the beginning my work focused on a sleep deprivation study in rats, which was aimed at determining if there is neurological control over the immune system. I assisted in sleep depriving the rats and profusing them. To study the immune response in these sleep deprived rats, they were injected with LPS to induce an inflammatory response, and then TNF-alpha levels were measured from a blood sample.

The next project I worked on was a similar study on neural control over the immune system, but this time instead of using sleep deprivation we induced a torpor state in the rats using microinjections of muscimol, a GABA agonist, into the raphe region of the brain stem. I assisted with prepping for the surgery to place the cannula to administer the muscimol, the surgery itself, the six hours of injections to send the rat into a torpor state, and the profusion and collection of the rat's brain. After doing this multiple times I was able to hand the Ph.D. student the tools she needed without her asking, anticipating her next move, and prepped all the drugs used throughout the surgery without guidance. While at Dartmouth I am the one doing the cutting, only Ph.D. students are allowed to perform surgical procedures on animals, so I instead learned how to work as a team during surgery. I believe this to have helped my own surgical skills, as even though I did not wield the scalpel, I was able to get to a point where I could assist the Ph.D. without her ever having to stop working, and knew enough that when trouble arose I had the right tool ready, whether that was a drug, equipment, or my own hands. I would later use a kryostat to create sections of the brains we collected and assist in preparing the slices for imaging. Some of the rats also had their kidneys, liver, and intestines removed to study changes in mitochondrial function and microbiome composition.

In addition to these projects I helped in checking the rats after surgery, cleaning-up the lab, recording data, and calibrating brain thermometers. One of the most exciting

side tasks was learning how to score sleep using EEG, EMG, and thermal data. Working with a sleep related problem at Dartmouth (Sudden Infant Death Syndrome), this was thrilling for me and made me feel more prepared for future work at Dartmouth.

My favorite project to work on was the torpor project as it is something that is not being done anywhere else in the world. Rats are not naturally hibernating animals, and being able to induce a torpor state in them felt like watching history being made. The fact that the technique was already polished and published and now being used by the lab to study other aspects of physiology was amazing. Although I was never able to observe it myself, the group is also working now to try and induce a torpor state in pigs. I felt extremely privileged being present for the discussions on the challenges with the work on the pigs and comparing them to the techniques discovered to work in rats. I also enjoyed working on this project the most as I felt it gave me the best insights into research in Italy. I worked with my peers to create a great deal of the tools we used for the experiment: the EEG, screws to keep the cannula and brain thermometer in place, and the observation chamber equipment used during the six hours of injections. This experience helped me realize both how wasteful labs in the United States are in comparison, and how lucky U.S. labs are as well despite N.I.H. funding being cut. I always thought that the problems in U.S. labs I have worked in were hard due to lack of funding, such as limits to the number of animals we had, the quantity of antibodies we could purchase, etc. Seeing the amount of tools that are re-used and handmade in Italy has taught me what a true lack of funding looks like. It was fascinating to be working on projects at the forefront of science, but under conditions that seemed like they were from 20 years ago in the U.S.

The project that was the hardest to work on was the actual sleep deprivation portion of the sleep deprivation project. Keeping a rat awake for 12 hours is not thrilling work and becomes harder as time goes on as a rat deprived of sleep is much like a Dartmouth student as finals approach, doing its best to sleep at every moment something isn't forcing it to be awake. To get through the 12 hours we would take 30-minute shifts between three lab members, so two of us were outside of the container watching the EEG and EMG data coming in while the other person made sure the rat stayed awake. If you were one of the two people outside of the container things were better as you could talk to the other person at least. It was during these times that I discovered a lot about my co-workers, including their personal lives, views on the U.S., as well as about their respective cultures.

Expectations vs. Experience

Before arriving in Italy I thought that everyone would speak English in the lab all the time because I had been told that the lab work was conducted in English. This turned out to not be entirely true, as although everyone knew English, Italian was used the most often. At first this was quite difficult as there was a lot of slang I had to learn that was never taught in my Italian courses at Dartmouth, but by the end I felt like I learned how Italian is truly spoken by university students.

Having only worked in the U.S. I assumed I would be working with the same autonomy as I do in my Dartmouth lab, no supervision and no limits on what experiments I would be allowed to run. The Italian system is extremely different, however. Everything is done as a team, and only the Ph.D. students directly handle the most difficult

experiments (i.e. surgeries). This made me appreciate what I have learned so far as an undergraduate at Dartmouth, and also taught me how to learn from a supportive role and keep a lab going as a team rather than everyone working on individual projects. Just like in a U.S. lab however, the primary investigator was only seen about once a week, as direct supervision was the responsibility of the Ph.D. students. I always had the primary investigator's support though, and knew how to find him if I needed his help.

Work Environment + Work Life Balance

While some things were exactly the same as working in a lab in the U.S., other things were extremely different. Just like in the U.S., although everyone knew that a certain hierarchy existed between the thesis vs. the Master's vs. the Ph.D. students, everyone treated each other with the same respect and hung out together in the lab as equals. The primary investigator was also mostly a far off presence as in the U.S., with most of the lab supervision given to the Ph.D. students. The greatest difference came from the restrictions applied to non-Ph.D. students. Unlike in the U.S. where even undergraduates are allowed to run their own projects, perform surgeries on animals, and be included on publications, only Ph.D. students are allowed to do these things in Italy. These differences created a bit of wonder and speculation between the thesis students and myself upon my arrival, as they desperately wanted to be able to do more and here I was having done many of the things the Ph.D. student did everyday. This did not create a barrier between us however, as it merely led to questions about how the U.S. education system works and conversations about the limits of the Italian system.

There was more than just interesting conversation with the thesis students about differences between our undergraduate experience however, as I learned there is a greater sense of near hopelessness and despair with finding work after university, due to the miserable conditions of the Italian economy. The goal of nearly everyone I worked with was to get out of Italy after their education was finished, and from what they told me this is the common ideology of students in Italy, especially in the sciences as even physicians and engineers have trouble finding work anywhere in the country. It was quite disheartening to hear about their fears for the future as it felt more desperate and potent than anything I had ever heard in the U.S. among undergraduates.

Working in a lab means working weird, sporadic hours. While I never had to work weekends, I often had to come in early in the morning and stay late into the evening due to the nature of the experiments. This led me to be closest to the people who worked in my lab, as there was not much time to socialize outside of work. When I was not working, I was lucky enough to have roommates that were also students at the university. Two of my roommates were from China, and so it was great to be able to lean on each other, discussing the differences between Italy and our respective home countries. We struggled together to learn how to do laundry without a dryer, cook with a gas oven, and get creative with olive oil!

Personal Growth, Skills Learned + Cultural Differences Encountered

When I first arrived in Italy I definitely had a rosy view of the culture. I thought that everyone wanted to know your story and wanted you to know theirs. This was true to

an extent in the lab I worked in, as my co-workers were very curious about my life in the U.S. and shared their weekend adventures with me. After the first few weeks however, I was hit by the fact that no one out in public ever acknowledged each other, and actually seemed to be quite rude to each other through the view of American etiquette. No one watches where they are going and will just run into each other in crowds, no one says excuse me or apologizes for bumping into someone on public transit, people do not give up their seats for the elderly or passengers with children on public transit, and only business employees will say thank you. What I discovered from my co-workers is that to an Italian it is considered very strange to speak to someone you do not know and that everyone just goes about in their own little world and just doesn't burst the bubble of those around them. I did notice, however, that if I ever asked for help with how to get somewhere people were always more than happy to show me where to go, or even go with me sometimes. This was especially helpful during my arrival to Bologna when I could not find my apartment. Perhaps the best example of how Italians are still extremely kind people even if they do not interact with strangers normally, is that one day I had forgotten to bring bags to the grocery store and so was carrying everything by hand in giant piles. I of course dropped the groceries and was on the ground trying to pick them all up when a lady walked by on her phone, and without really stopping or ending her phone call, handed me some plastic bags with a smile and kept walking. It took a while to not judge the actions of those around me as being rude or inconsiderate under my American perspective, but I have learned the Italian way now and enjoy their ability to be interconnected without ever truly intruding on each others' lives.

I was very interested in finding out how Italians and other Europeans view the U.S. and its citizenry. The common theme I discovered was that Europeans view the U.S. to be a very sad country where people are generally not happy and there is a constant threat of violence from the police and other citizens. They believe the availability of guns in the U.S. to be a large source of this violence and do not understand why it is so easy to gain access to a firearm. Everyone in my lab also thought that all Americans were overweight and this seems to be a common view for people both from Europe and China, as my Chinese roommates also commented that most people in China believed the same stereotype to be true. While the people in my lab had heard of many American cities, including my hometown of Denver, Colorado, the general Italian public seems to really only know about New York, Miami, and L.A., as these are the cities I was always asked about when I went on tours in other Italian cities. All the open markets I visited also contained New York City merchandise, and you can always spot some sort of clothing with New York represented on it in the city center.

The best part of living in Italy is definitely the food as eating is not just fulfilling a biological need in Italy. Fast food does not exist for a reason in Italy, as you are supposed to take your time to enjoy your meal, to converse with whom you are eating with, and to take your time so as to try multiple items at the eatery. I made the mistake of trying to pay for my pastry and coffee right after ordering them, and was immediately told to wait until I was done in case I decided I needed to try other things before leaving the cafe. I have since become considerably calmer when I go out to eat, and really try to focus on mealtime as a break from the day to just enjoy life. I hope to bring this mentality to my daily ritual at Dartmouth during my next academic term, as so often I have crammed in work to meals so as to not lose any time.

The best part of my job was the people I worked with. I learned so much from them, and it was a truly diverse array of experiences to learn from. I worked with four undergraduates, a medical student, a Master's student, and a Ph.D. student. I learned that there is fantastic folk music in Italy that we would label as alternative in the U.S., the Hunger Games series is a huge phenomenon in Italy (all my co-workers were counting down the days until the last movie came out in November), and that playing jokes on one another is a key part of being Italian and showing someone you care about them.

The lowest moment of my time in Italy occurred on my very first night unfortunately. My flight from the U.S. had involved arriving in Iceland at 6am, then being delayed for three hours after waiting for four already for my flight to Copenhagen where I had a 23 hour layover, and only then did I finally arrive in Bologna around 9pm (two days after the beginning of my journey). I had looked on Google maps at how to get to my apartment, had instructions from my Airbnb host on my phone, and felt sure I could get there despite being sleep deprived and suffering from jet lag. I turned out to be very wrong as I started off by getting on the wrong bus, which thankfully a lady helped me get off and get onto the right one. Then, despite finding out later that I could have been to the apartment within five minutes from the stop I got off next, I wandered around for a half hour before calling my host and having her try to help me figure out where I was and how to get to the apartment. She wasn't really any help as she was in Milan and didn't live in Bologna. I took a chance and asked some teens if they knew how to get to the address of the apartment, and that was when my luck finally turned around. It was truly miraculous as it turned out one of the teens lived right next to my building, and so he walked me to my apartment, leaving his friend behind. I have never been more grateful in my entire life, and feel so lucky that I found this young man when I did. This was also the moment where my Italian was the most important skill I had, as despite being told that most Italians speak English, I came to realize during my stay very few people outside of the major tourist destinations speak English, and so if I had not been able to speak Italian with that teen my first night, it could have been a bigger ordeal than it already was. This also taught me that while we are taught to mistrust all strangers in the U.S., sometimes a complete stranger can be your greatest asset.

Lasting Impact

Overall, I loved my time in Italy and cannot believe that it is over. I would highly recommend working abroad to anyone, as I feel like working abroad has given me a deeper connection to my host city than many of my friends experienced on their study abroad programs. There is something about having to navigate a foreign work place and truly experiencing the day-to-day life of an average citizen that opens your eyes to the real culture of where you are living. I hope to keep in contact with the many friends I made in Italy, and thanks to the numerous scientific conferences in Europe, I hope to see some of them again.

After having seen the collaboration that goes on at the Università di Bologna, I hope to be able to work with labs from around the world in my own research work going forward. While I have realized that I prefer the U.S.'s graduate program structure, as U.S. graduate students are allowed to do much more than Italian graduate students, my time here has made me consider doing my post-doc abroad. The best thing I learned while in

Bologna is that in order to learn all the skills you can to be a great scientist, you must visit labs all over the world as everyone has a different approach and if you stay in one place, in the words of one of the professors in Bologna, “you will surely become a fossil.”