The 6th MERIT Overseas Training Reports

2018 2/26-3/4 @Chicago, USA

Introduction

This overseas training was held in a part of Materials Education program for the future leaders in Research, Industry, and Technology (MERIT) from 26th February to 4th March in 2018. The 23 participants chosen in Applied physics, Electrical engineering, Chemical system engineering and Chemical & Biotechnology of the school of Engineering and Physics and Chemistry of the school of science and advanced materials science of the graduate school of frontier sciences visited the famous university, such as North Western Univ. or Univ. of Chicago in Chicago, USA.

Chicago, the third biggest city after New York and Los Angels, has many famous research institutions because of their long history and development. In this oversea program, we visited North Western Univ. and made a tour of the laboratories on 27th February. After this visit, we went to the laboratories individually in the institutes in and around Chicago for three days from 28th February to 2nd March. In addition, we discussed with the members in the laboratories for their study theme.

In this report, we tell our experience of this program. It is sure that the experience we can get in this program must affect our daily study life. Therefore, please read the reports if you want to know the detail of our growth by this program.

We are grateful to Prof. Koseki, Prof. Kawasaki, Prof. Ichikawa, Prof. Sawada, Prof. Shimada and those who helped us in Chicago.

Members

Name	Affiliation
Yusuke Takeshige	Eng.・Appl. Phys.
Yudai Hayashi	Eng.・Appl. Phys.
Makoto Masuko	Eng.・Appl. Phys.
Kosuke Takiguchi	Eng.・Elect.
Kosuke Ooe	Eng.・Mat. Eng.
Rinpei Kamegawa	Eng.・Mat. Eng.
Hiroaki Nakade	Eng.・Mat. Eng.
Shun Suginome	Eng.・Chem. & Bio.
Yuki Hosono	Eng.・Chem. & Bio.
Kiyoshi Morishita	Eng.・Chem. & Bio.
Jun Usami	Sci.・Phys.
Takase Shimizu	Sci.・Phys.
Masashi Hosoi	Sci.・Phys.
Takahiro Doba	Sci.・Chem.
Keishiro Yamashita	Sci.・Chem.
Tang Nan	Front. Mat.
Yutaka Iwasaki	Front. Mat.
Tatsuki Sato	Front. Mat.
Chizuru Sawabe	Front. Mat.
Takako Noritomi	Front. Mat.
Syunsuke Hasegawa	Front. Mat.
Matsumaru Taiki	Front. Mat.
Kiyotaka Mukasa	Front. Mat.

MERIT Overseas training report

Department of applied physics, School of Engineering

Yusuke Takeshige

【February 28th Awschalom group, The University of Chicago】

On the first day, I visited Awschalom group in the University of Chicago, with 6 other MERIT students. Though we could not meet Professor Awschalom, but graduate students Mr. Fukami acted as a local host. Each member of the group told us what kind of topic they investigate with showing their experimental setup, equipment, and results. Though, current main topic of Awschalom group is NV center of diamond or SiC, there is a member whose current topic is topological insulator as the same as mine. I mainly focus on electron transportation of Topological insulator in low temperature, while he mainly focuses on optical response. Despite such difference, the discussion with him was so fruitful that we discuss about how to protect topological insulator from oxidation with considering the influence on measurement.

At Awschalom lab.

After the lab tour, we had a chance to see the clean room, which was the shared facilities of the university. The clean room was newly established a few years ago by the donation, and people can use up to date equipment there. In the other universities, we also saw many buildings or facilities which were founded by donations and felt that donation was much popular in U.S. than Japan.

【March 1st Mason group, The University of Illinois Urbana-Champaign】

On the second day, I visited Mason group in the University of Illinois Urbana-Champaign. It takes 2~3 hours from Chicago to Champaign by bus or train. I took train for going to Champaign and took bus for coming back to Chicago.

Mason group deals with mesoscopic system, including the hybrid system of superconductor and topological insulator, which is my current target. Therefore, I was looking forward to visiting this lab in this oversea program most. In the lab, after seeing the equipment, I received detail explanation about some members' research topic. I spent fruitful time talking with the person whose research topic is topological insulator and superconductor as the same as mine. In addition, Professor Mason spared time for me despite her busyness and gave me advices about my experiment. It was productive that she pointed out problems I have overlooked.

【February 28th Cleland group, and Ryu group, The University of Chicago】

On the third day, I went to the University of Chicago again, and visited Cleland group with Mr. Shimizu. After that, though I have not planned to do so, I visited Ryu group with Mr. Hayashi and Mr. Hosoi.

"Quantum" Café in The university of Chicago

Cleland group focuses on the superconducting q-bit and get great results especially in the topic of coupling between q-bit and mechanical oscillator. Though we could not meet Professor Cleland, but postdoctoral member invited us and explained us about group research. The most impressive point was that the lab had some big themes and multiple members were assigned to the same project. This make it possible to conduct research efficiently by dividing tasks. I was also impressed that quantum information technology has been getting much attention in the world and it is becoming easier to get money in this field.

In the Ryu group, professor Ryu explained us his research issues and talked about the difference between university of Japan and America. Professor Ryu investigated about topology of matters theoretically and especially about the topological classification by considering electron-electron interaction these days. Because I investigated about topological insulator experimentally, talking with him gave me great impression. In addition, his talk about the difference between Japan and America was interesting considering that he got doctoral degree in Todai and experiencing both Japan and American way of research.

【Acknowledgement】

I am grateful to Dr. Shimada and Dr. Sawada and other MERIT stuff, who managed this trip and accompanied us during this visit taking care of us so much. I also feel great thankfulness

for groups which permits my visit. In addition, I would like to show my appreciation for Mr. Takiguchi, who took contact with Awschalom group and Mr. Shimizu, who took contact with Clerand group.

MERIT Oversea Program in Chicago

Dept. of Applied Physics, Takahashi Lab.
M1 Yudai Hayashi

This time, we visited Chicago as a oversea program of MERIT. In the first day, we all visited Northwestern University and communicate with students. And in the other days, we made appointments with various research groups and visited them.

At the Northwestern university, I was strongly inspired by the communication with students. I had little experience communicating with students study in the university abroad, therefore it was valuable experience that I could talk about not only study but also life as researchers.

After the first day, we visit laboratories whose studies are similar to those of each other. I visited research group of professor David Awschalom in the second day and professor S. Lance Cooper in the third day and Dr. Shinsei Ryu in the last day. I had little experience to communicate with researchers who study in abroad. Therefore, I was worrying about whether I could communicate with them, however, when I actually talk to professor and students, they explained many time until I understood, in addition, they listen to my bad English seriously. Thanks to them I think I could acquire a lot of things in this 3 days visit. Not only discussion, I could also learn a lot from the experimental setup they actually use. We cannot know from papers what they use to get data, so knowing the environment is large gain for me.

Fig1 In the Awschalom lab.

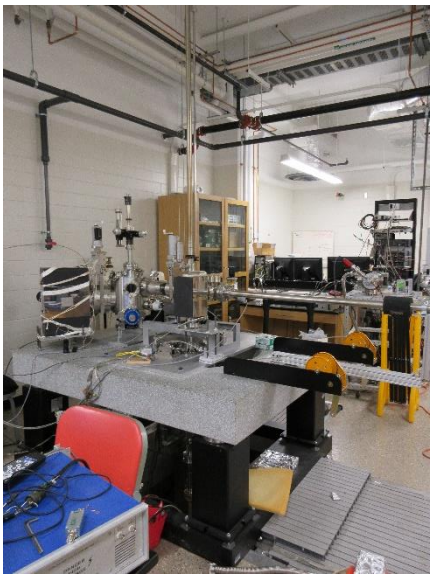
Thorough this oversea program, I was inspired in many levels. By knowing the environment of research facilities, I feel I want to study in the such facilities. By discussing with professors, I could acquired diversified viewpoints about my own study I had never thought. I want to utilize the experience and knowledge I got thorough this visit to my study.

MERIT overseas training report

Department of Applied Physics, M1
Makoto Masuko

【May 28th, University of Illinois Urbana-Champaign Madhavan Lab.】

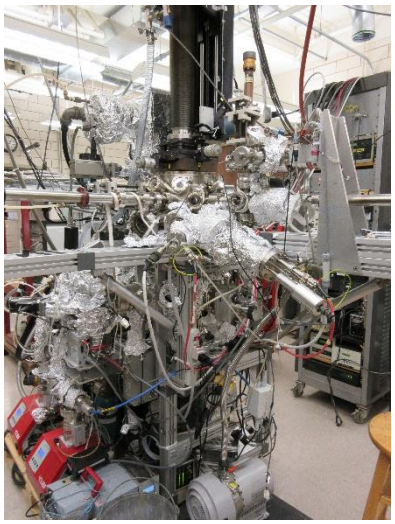
On the first day, May 28th, I visited Madhavan Lab. in University of Illinois Urbana-Champaign. In Madhavan Lab. they study various materials by using STM, and they kindly explained their STM equipment and studies to me. Especially, Dr. Zhenyu Wang, a postdoc of Madhavan Lab., told me his study on doping effect on layered perovskite $Sr_3Ir_2O_7$, and it was very interesting to me because I also studied perovskite-type iridium oxide. Also, since our study is based on certain material, I felt that the attitude to study of the members in Madhavan Lab., whose studies were based on certain equipment STM, was different from ours. Then, I also attended the lab meeting, in which the students and postdocs did rehearsals of the presentations for APS.



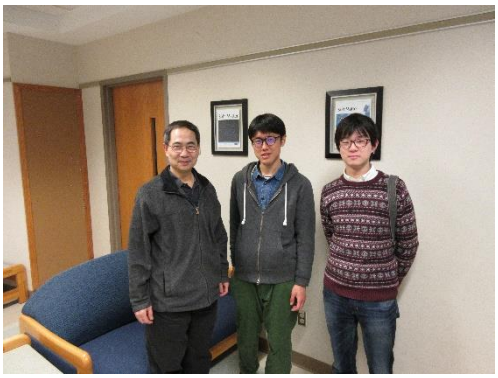
STM

【Mar. 1st , University of Illinois Urbana-Champaign Chiang Lab.】

Next day, I visited Prof. Tai-Chang Chiang in Univ. of Illinois U.-C. with Daiki Matsumaru. They mainly study topological materials by using ARPES, and they kindly explained their ARPES equipment. Then, I gave a seminar of 30 minutes on our current study in the regular meeting of Chiang Lab.



ARPES equipment directly connected to MBE chamber

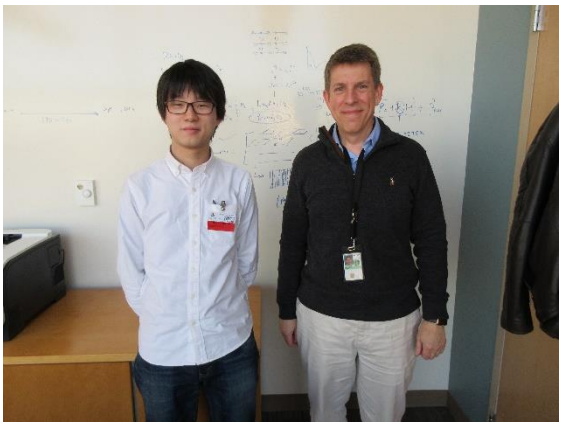


Together with Prof T.-C. Chiang (left)

【Mar 2nd, Argonne National Laboratory Dr. John Mitchell & Dr. Axel Hoffmann】

On the last day, I visited Dr. John Mitchell and Dr. Axel Hoffmann in Argonne National Laboratory. They provided me a precious opportunity to give a seminar on our study, and about 20 researchers kindly attended my seminar. There were many questions and comments after the seminar, and I believe that many of them got interested in our study. Also, Dr. Mitchell kindly arranged appointments for me to visit each researcher's office, and the discussions were all impressive. Especially, giving a seminar and having discussions with the researchers in Argonne were the greatest experience in this overseas training.

Together with Dr. Hoffmann



Together with Dr. Mitchell

【Summary】

Making appointments with and visiting 3 researchers by myself were great experience for me. Especially, giving a seminar at Argonne and Chiang Lab. was very valuable. Through this overseas program, I recognized how sufficient and also insufficient my knowledge of condensed matter physics and ability of English are, so I would like to make use of this experience as much as I can in my future study.

【Acknowledgements】

I would like to show my appreciation to professors and staffs in MERIT program, Dr. Shimada and Dr. Sawada, who kindly came with and helped us in the US, and Prof. Madhavan, Prof. Chiang, Dr. Mitchell, Dr. Hoffmann, and all other researchers who warmly accepted my visit.

MERIT Oversea Program Report

Electrical engineering and information systems, M1, Kosuke Takiguchi

In March 2018, I visited North Western University and University of Chicago for this oversea program in MERIT. I have a look around three laboratories and discussed them about their and my studies. Above all, these experiences are greatly fruitful for my student life.

[Feb. 28th Awschalom Lab.@University of Chicago]

Prof. David Awschalom is one of the most notable researcher in the field of semiconductor spintronics. My study field is same as his one so, of course, I am very excited to this visit. Their main research topic is Nitrogen Vacancy (NV) center in diamond, which consists of C, and silicon carbide, SiC. The NV center in these crystals behave as a “spin”, which means not a spin of electron and shows many interesting physical phenomena. The group uses optical method to investigate these objects.

I visited his group with six colleagues like the right picture. Unfortunately, Prof. Awschalom was so busy that we cannot see him at that time. But, the students introduced their experimental equipment for us. Although I am not so familiar with the optics, their explanation was kind and easy to understand. So, the first day of my trip ended with great satisfaction.

[Mar. 1st Center for Quantum Devices @North Western University]

The Center for Quantum Devices mainly studies the semiconductor devices and their strong point is to grow the greatly beautiful III-V group semiconductor crystals. In the field of semiconductor electronics, the quality of the crystal is crucial for making the devices. I also use the III-V semiconductor and it is very important for me to grow new materials related with the III-V semiconductors in my study.

Professor Manijeh Razeghi is the director of Center for Quantum Devices. She listened to my research talk eagely. In addition she introduced me to Professor Abbas Haddadi, who is a

member of this faculty. He is a professional of the growth of the heterojunction of III-V semiconductors. Especially, the system he study is same as mine and the discussion with him is, of course, very valuable for me.

[Mar. 2nd Wessels Lab @North Western University]

My research field is called “semiconductor spintronics”, which means that the we introduce the spin of electron into the semiconductor technology. In this field, the ferromagnetic semiconductor is a most important material. Professor Bruce Wessels is a one of the most prominent researchers of the ferromagnetic semiconductor.

The discussion with him was very fruitful because he convinced me of the position of the study. His field is the closest one for me in these three laboratories so that what he talked to me is especially meaningful.

【Acknowledgement】

I am grateful to Dr. Shimada and Dr. Sawada and other MERIT stuff, who managed this trip. I would also like to express my gratitude to Prof. Awschalom, Prof. Razeghi, Prof. Haddadi, Prof. Wessels and their group members for accepting my visit.

Report of the MERIT Overseas Program

Dept. of Materials Engineering, Master 1st student, Kousuke Ooe

I visited the Northwestern University, University of Illinois at Chicago and Argonne National Laboratory in individual time of the MERIT overseas program. Here I report the abstract of the three days (Feb. 28th – Mar. 2nd).

- 2/28 Visit Prof. Dravid group

On the first day, I and my colleague Mr. Nakade visited Prof. Dravid group in the Northwestern University. This group belongs to the Department of Materials Science and Engineering and researches about battery materials and biomaterials by electron microscopes. Firstly, we met Prof. Wu and talked about us and our research. Then he talked to us about the research there of battery materials. After that, we saw facilities there. Since our group uses electron microscopes, there were similar microscopes or machines for specimen fabrication. However, Prof. Dravid group focuses on biomaterials also, so we saw cryo-electron microscopes and specimen fabrication machines for them and they were interesting for me. After, we talked with researchers about their research and then Prof. Dravid spared time for us and we talked for a short time. He said that we should come for long enough time to do research if we come to Chicago.

- 3/1 Visit Prof. Klie group

On the second day, we visited Prof. Klie group in the University of Illinois at Chicago (UIC). This group belongs to the Department of Physics and researches about solid state physics by electron microscopy. We met Prof. Klie and firstly attended a practice for presentations at APS (American Physical Society) by students. Though the style of the practice was usual as students gave presentation and then Prof. Klie gave comments, the research contents were so interesting and Prof. Klie's comments were very passionate. After that, we went to lunch with students and researchers.

In the afternoon, we saw facilities around there. Basically, the facilities were similar with our group's, but there was a very old and historical electron microscope which I heard about only in papers. This was a very valuable experience for me. After that, while Prof. Klie went for a class, we saw an observation experiment for biological specimens by STEM (scanning transmission electron

microscope). The STEM observation of biomaterials was unfamiliar with us and it was interesting. Finally, we gave presentations of our researches to Prof. Klie and discussed with him. Giving a presentation by English was a little difficult, but he seemed to be interested in my research and gave me a lot of questions. This was very meaningful discussion. Prof. Klie told me that he would join the international conference which I would join a half year later, and I would like to give better presentation at the conference.

- 3/2 Visit Dr. Wen group

On the third day, we visited Dr. Wen group at the Argonne National Laboratory. Because we needed an access permission to enter this laboratory, we did procedures via Dr. Wen. If next MERIT students visit the national laboratories in the U.S. for the overseas training, they should take contacts for the appointment earlier because of the procedures.

This laboratory locates at the suburb of the downtown and it takes about 30 min. to get there by a car. In this time we used Uber with other MERIT students. Dr. Wen had a meeting suddenly and we were not able to meet him. In this time, we met student and researchers in his group and they took us to the electron microscope center of the laboratory. The electron microscopes there were different company's products from us and it was interesting. After that, we went to see the computer facilities and APS (Advanced Photon Source). Especially APS was very large and I heard that this was famous facility in the U.S., and many kinds of researches are conducted using X-ray. After seeing facilities we took a lunch with members of Dr. Wen group and then we went back to the downtown.

- Acknowledgements

I thank the professors and the MERIT office for organizing this fruitful program and I also thank Dr. Shimada and Dr. Sawada for leading a party of us at Chicago. I am grateful to Mr. Takiguchi and Mr. Matsumaru for acting as a leader and sub-leader of us. Furthermore, special thanks to all professors, staffs and students hosting us at Chicago. They made my visit so interesting and exciting. Finally I would like to thank my supervisor Prof. Shibata and Prof. Ikuhara for helping me with considering where to visit at Chicago and taking appointments.

Rimpei Kamegawa

Miyata lab, Depertment of Materials Engineering

Here I report the visit to four laboratories according to the following schedule during free time.
First half of 2/28 :Thaxton lab (Northwestern, Chicago campus) Lab tour, discussion
Latter half of 2/28: Stupp lab (Northwestern, Chicago campus) Lab tour
First half of 3/1: Mirkin lab (Northwestern, Evanston campus) Lab tour, joining to seminar
Latter half of 3/2: Stupp lab (Northwestern, Evanston campus) Presentation, discussion
3/2: Hubbell lab (Chicago) Lab tour, discussion

First half of 2/28 :Lab tour and discussion at Thaxton lab

I visited Thaxton lab in Chicago campus of Northwestern University and discussed my research issues with the lab members in the first half of February 28th. Professor Thaxton has Ph. D and M. D and his laboratory was trying to cure cardiovascular diseases with HDL nanoparticles from the medical and engineering points of view. The interesting points were that the lab used the nanoparticles as a delivery system itself, or used them as ligands to scavenger receptors on macrophages in combination with other nanoparticles.

Latter half of 2/28: Lab tour at Stupp lab

In the second half of 2/28, I visited Stupp laboratory which also located in Chicago campus of Northwestern University. The institute to which Stupp lab belongs has a lot of experimental equipment and each laboratory shares the equipment, which is different from our department. I think both systems have advantages and disadvantages, but the system of the institute of Northwestern University can facilitate the communication between members in different labs and the communication consequently make their researches move forward and generates a chance of cooperative research.

First half of 3/1: Lab tour and joining to seminar at Mirkin lab

Mirkin lab in Evanston campus of Northwestern University has over 50 members and the research in the lab is very famous in my research field. The lab has professor room, staff room, student room and experimental room in the same floor, and the structure gave me the impression that the members can work without any stress. As I felt when I visited other laboratories, there are several staffs who engage in administrative works other than the professor, and the researchers has an good environment where they can concentrate on their researches. I understand the reason why high-level research is generated on after another, witnessing the fact that large amount of money is spent to the environment where each member can concentrate on each work. After the lab tour, I joined seminars of two research groups. Because there are many research members in the lab, it seems that the members have fewer chance to present their progress. However, with such situation, each member present his/her research background, motivation, research plan, results and discussion, and future plans in a very logical way. I was able to sense that they naturally acquire skills necessary to do a promising research because they usually do their research thinking their research logic.

Latter half of 3/1: Presentation and discussion at Stupp lab

Although I have already visited Stupp lab in Chicago campus on the first day, I also visited the same lab in Evanston campus with other four MERIT fellows and had a chance to present my research for about 20 minutes. Since I had had several experiences to present in English, the presentation was not hard very much. But I keenly realized the lack of my listening and speaking ability in English at the Q & A time. After finishing presentation, Dr. Sai kindly introduce the campus and we had dinner in the near restaurant. Dr. Sai gave me meaningful advice also in the dinner time because he had an experience to use the same material I am using.

3/2: Lab tour and discussion at Hubbell lab

On the third day I visited Hubbell lab in the University of Chicago. The researches in the lab are more biologic compared to the lab I visited on the first and second day. There, I had a chance to discuss with Dr. Ishihara and Mr. Asano while having lunch and to take a lab tour after having lunch. The most impressive talk was that Dr. Ishihara was planning to launch a startup with his recent promising results in his research. When your research is close to application, it is sometimes difficult to obtain remarkable results. However, once you obtain prominent results, you can put it to practical

use at a moment. I got motivation from his talk because I would like to utilize my research to society through some entrepreneur activities in the future. Also, I was stimulated by Mr. Asano's talk. He came to the U.S. after his graduation from the University of Tokyo. The reason why he decided to go abroad is that when he was undergraduate student, his friend who studied abroad told him that the life in the U.S. was very fun and he was jealous of his friend. I wanted to feel free to study abroad because Dr. Ishihara and Mr. Asano seemed to have productive lives in the U.S.

Conclusion

I was very motivated through my visiting to various high-level laboratories for three days. I thought our laboratory equipment was just as good as that of the laboratories I visited. However, I felt that these laboratories and their institutes had stronger motivation to make better environment and do better research compared to us. Of course, it is difficult to simply compare our and their situations, but I would like to use their attempt as a reference if it can be useful to our laboratory or my research life. Also, it was very meaningful that visiting to foreign laboratories and talking or discussion with the members had me feel free to do research abroad. I would like to prepare a chance to do my research abroad by myself in the near future.

I really thank Dr. Sawada and Dr. Shimada for leading the overseas training, MERIT staffs for managing this trip, and all people I met in the universities I visited.

Report of MERIT oversea training tour in Chicago

Hiroaki Nakade, Department of Materials Engineering

Arrived on 2/26, we stayed in Chicago for 5 days. On 2/27, we had a campus tour together in Northwestern University and breakout sessions with Northwestern students. From 2/28 to 3/2, we visited 3 or more laboratories which we each would like to see. Because I use transmission electron microscopy (TEM) and Scanning TEM (STEM) for my research, I visited some laboratories researching on S/TEM with my colleague Ooe-kun.

【2/28】Northwestern University / Prof. Dravid. P. Vinayak group

In this group, we saw some facilities and heard an introduction of undergoing research topics of postdoc researchers. It seemed that researches on biomaterials and polymeric materials were prosperous here, which I also felt in the campus tour in a previous day, and many people used TEM for Cryo-TEM method. Actually I knew next to nothing about it and it sounded really interesting. Finally, we met Prof. D. P. Vinayak, who was the PI of the lab, and he said that "before we had some Japanese researcher, but recently not. If you come to our lab, I'll welcome you!"

Fig: Gate of NU

【3/1】University of Illinois at Chicago / Prof. Robert. F. Klie group

We visit this lab because Prof. Shibata, who is the boss of our lab, recommended us to visit Prof. Klie, his old friend. In this lab, we also saw some group facilities and after that we joined a meeting for APS conference. Besides, we had a presentation and discussion of our research topics with Prof. Klie. He gave me some very good questions and it was the most directly effective experience for my research through this oversea training program.

【3/2】Argonne National Laboratory / Dr. Wen Jianguo group

The last of laboratory-visit schedule, we visited Argonne National Laboratory. Unfortunately, Dr. Wen was absent because of an urgent meeting. Instead, postdoc researchers showed us some laboratory facilities and held a tour of whole Argonne National Laboratory. In this lab, they used the microscopies made of FEI, which was different from ours (we use JEOL's). It was so interesting that I took many pictures of the machine and operation software. We also saw the synchrotron (ATLAS) in the physics division. It was my first time to see a synchrotron, so I was very impressed with the hugeness of it.

MERIT Overseas Training Report

Department of Chemistry and Biotechnology, Aida Laboratory, Shun Suginome

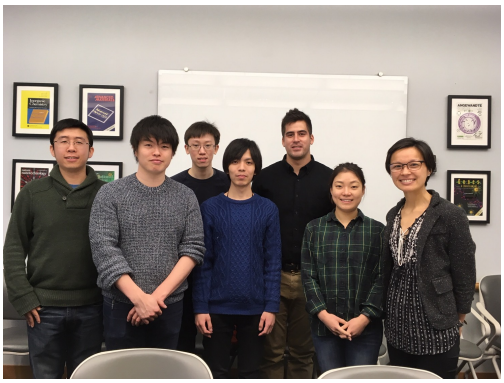
I participated in the MERIT overseas training program to visit Northwestern University on February 26th to March 4th, 2018. Though I experienced a lot of things during this program, especially I will report about the events on three free activity days (February 28th to March 2nd), where I got in touch with professors or lab managers and made appointments by myself in advance of the visit.

February 28th, Visit to Prof. Omar Farha Lab @Evanston

Farha Lab is a famous laboratory for the works on Metal-Organic Framework (MOFs), which is also the main player in my own research. Although I could not make an appointment successfully in Japan, I was able to visit there with the aid of Ms. Andrea D'Aquino, a PhD. student at Mirkin Lab who showed me around the tour on 2/27. Three PhD. students welcomed me and kindly did a lab tour for me in spite of such a sudden visit, and I can looked around their labs and facilities. In particular it was really surprising to see that a one large room (called “adsorption lab”) was filled only with a number of adsorption equipment and there is no other equipment in this room, considering our lab has only one adsorption equipment. In addition, they explained about the research carried out at Farha Lab in detail using a poster that they said was made very recently. This is the only chance to visit a lab alone during the three free activity days, and I recognized the lack of my English ability, especially a listening skill. So I made up my mind to study English more after going back to Japan.

February 28th, Visit to Prof. Samuel Stupp Lab @Chicago

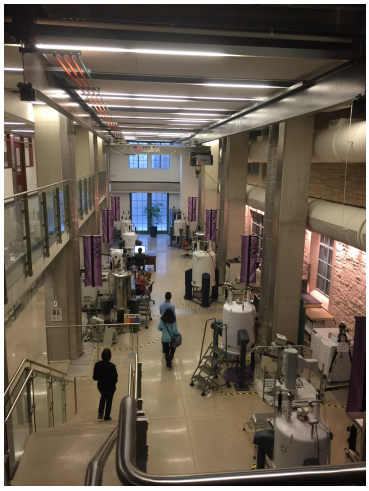
Stupp Lab is a world famous laboratory in the field of Self Assembly and has a lab on both the Evanston campus and the Chicago campus of the Northwestern University. On this day I visited the Chicago campus, where they are mainly focusing on the research on biotechnology. The lab in Chicago campus is the part of the research institution called Simpson Querrey Institute (SQI), and prof. Stupp is the director of this institute. After looking around the facility of the lab for a while, one researcher explained us the research which aims to apply nanofibers made of amphiphilic peptides in vivo. What impressed me was that they explain about their research with showing the real thing.



We (Suginome, Kamegawa and Morishita) and the part of the members of organometallics subgroup in Prof. Chad Mirkin lab.

March 1st, Visit to Prof. Chad Mirkin Lab and Presentation in Group Meeting @Evanston

Chad Mirkin Laboratory runs the world top in research on colloidal crystals using gold nanoparticles and DNA and technology called Dip-Pen Lithography. we can participate in the organometallics subgroup meeting and I was able to have a chance to present my research in front of them because my research on MOF was the most relevant to the topic of this meeting among three of us. After 30 minutes' presentation and discussion, I was confident that I could finish presentation and Q&A part without any problems since one member told me that your presentation was quite impressive. After joining the subgroup meeting, we looked around the lab. Mirkin lab is a huge lab that holds about 60 members, and I was very surprised to see that one floor of the building was used only by Mirkin lab, and not only this floor but the upper and lower floors were partially used. I also talked to the lab manager, then I felt that they are very much confident that they are doing extremely hard work, and that's why they can always be the top runner in the world. This attitude towards the research was a good stimulus for me.



The NMR room in Evanston campus of Northwestern University.

March 1st, Visit to Prof. Stupp Lab and Presentation in Group Meeting @Evanston

On this day I visited Stupp Lab in the Evanston campus. When I made an appointment, two postdoctoral fellows Dr. Kohei Sato (who took Ph.D. in Aida lab), and Dr. Sai helped me a lot. We had an opportunity to hold a meeting with members of the Stupp lab. All five students from the University of Tokyo could present their research for about 20 minutes. After the meeting, Dr. Sai tooked us to show the equipment used by Stupp Laboratories or common ones. A very large hall with nearly 10 NMR machines overwhelmed me.

March 2nd, Visit to Prof. Nathan Gianneschi Lab and Presentation in Group Meeting @Evanston

Gianneschi laboratory mainly engages in the development of materials oriented toward bioapplication. A group meeting was scheduled on this day, and I could join it and had a chance to make a presentation. Since the lab is mainly dealing with biomaterials, it was quite uneasy before presenting how much they could understand my own research irrelevant to bio application. However, finally I could discuss my research further than I expected. Especially they gave me advice based on their experience of development of materials and microscopic observation. For example, they asked me whether TEM can be used for the observation of the phenomenon occurring in my system, and they showed me the reference papers. It was a great help for me. During the presentation, I noticed that everyone could discuss freely and questions arose from everywhere. This atmosphere was quite fresh for me compared to the meetings held in Japan.

March 2nd, Visit to Prof. William Dichtel Lab @Evanston

Dr. Matsumoto, who took Ph.D. in Aida Lab and currently is a postdoctoral fellow at Dichtel lab, helped us to visit Dichtel lab. This lab mainly deals with two-dimensional porous materials, which is very close to the field that I am researching. I could not have enough time to deeply discuss the research unfortunately, but I was able to introduce my research very briefly and they gave me an advice. In the lab, there were many machines that are familiar with me, as I'm working on very close fields. Finally, Dr. Matsumoto showed us around 5 or 6 labs where there is the close friends of him. When entering other labs we can go into their rooms without hesitating, unlike the Japanese laboratory. I felt that there is almost no barrier between laboratories, which results in the many collaboration works.

Conclusion

Since I have never visited overseas laboratory and have made a presentation and discussion before this program, everything I saw was fresh. Discussing my own research with the members of the visited laboratory was a very good opportunity to think about the research from a different viewpoint which cannot be obtained by only staying in my laboratory. Also, when thinking about studying abroad, I was keenly aware of my absence of listening skills. Although it was only a few days stay, I could feel the good atmosphere of the American lab. I thought that I should bring back the good part of them and return it back to my research life

in Japan.

Acknowledgement

As I said above, I could do a very valuable experience by joining MERIT overseas training this time. I would like to express my sincere gratitude to all the persons related to the program, especially MERIT program staffs who planned this overseas training, Prof. Shimada and Prof. Sawada, who lead us during this program, professors and managers of the laboratory who accepted the visit and attendance to the meeting, and all the students and postdoctoral fellows in visited labs.

MERIT Overseas Training Report

Department of Chemistry and Biotechnology
M1 Yuki Hosono

From February 28 to March 2, I visited three campuses, Northwestern University at Chicago, Illinois University at Urbana Champaign and Illinois University at Chicago. I will make a report on them.

[Feb. 28th Stupp Lab.@Northwestern University at Chicago]

In Stupp laboratory, they are developing supermolecular chemistry and biomaterials using organic molecules with self-assembling ability. On Feb. 27th when MERIT overseas training course students acted as a group, I took a look at the Stupp laboratory in Evanston and talked with Professor Stupp. On this day I visited the facility in the laboratory in Chicago. Especially the laboratory is attached to the university hospital, since it puts a great emphasis on material development with a view to medical application, it was a meaningful tour consistent with my interests. Regarding the facilities of the Chicago campus, it was about the same as the University of Tokyo, but I felt the difference with Japanese universities that collaborative research was actively conducted. Even in the same research, the work is partitioned with people who synthesize organic molecules, people who perform bioassays, people who lead to medical applications, and feel that this leads to speeding up the progress of research. Also, using a model that imitates parts of the human body like the backbone, I was able to have a concrete image in the field of medical treatment which is hard to feel in my usual research life.

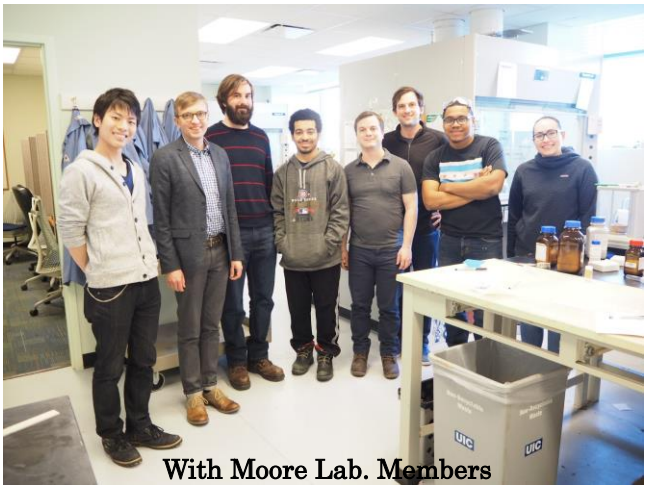
[Mar. 1st Zimmerman Lab.@Illinois University at Urbana Champaign]

In Zimmerman laboratory, they are developing molecules that specifically bind to certain repeat sequences of DNA. Originally aiming at the function with small molecules, actually relieving symptoms was confirmed for the disease model Drosophila. In recent years, they have extensively studied extensively such as extending it to polymers and developing biocompatible click chemistry. In this visit, in addition to facility tours, I also got a chance t have a one-on-one discussion with professors and students. With this small discussion system, it became an interactive discussion and I could listen to all what I wanted to listen to. Although it was a slightly different field from my field, there were some overlapping parts, leaving comments on synthesis

and assay systems, and being advised on my research, it was a very meaningful time. Aside from that, on the day the local staff gathered at the Illinois university and was striking to make the next contract advantageous. It is a sight that can hardly be seen at all in Japan and was overwhelmed by the size of the scale.

[Mar. 2nd Moore Lab.@Illinois University at Chacago]

In Moore laboratory, They are developing peptides that inhibit intracellular protein-protein interactions aiming at medical applications, and it is a laboratory in the middle of my research. Molecular design is undertaken with consideration of improvement of inhibitory ability and improvement of cell membrane permeability based on co-crystal structure etc of peptide inhibitors already obtained. On this occasion, I had a chance to present my research in front of the members of the laboratory and I attended the progress report meeting of the student closest to my research. I was very thankful that I could rarely experience other research laboratories, as well as witness the laboratory's raw research findings that are quite close to my research. Also, at my research presentation, it was a very useful time for discussion at a fairly deep point and to refine my research. However, I could not keep up with my English ability in deepening discussions, I also regretted. I was keenly aware of the importance of English.


With Moore Lab. Members

In addition, Prof. Moore introduced the opportunity to attend a meeting that Professor Moellering gave a presentation, who is a professor of Chicago University who I wanted to discuss with for a long time. Prof. Moellering has experiences postdoctoral course under Professor Cravatt who is a proteome owner. Proteome is not directly related to my field, but it is an interesting field and it is the most important research field indispensable for understanding life phenomena, so his lecture was really interesting. Also, I was fortunate enough to have lunch together and have a precious time.

[Summary]

In this overseas training, I learned about the research of world level researchers and learned

what kind of environment they are studying. In the laboratory visited this time, in particular, Northwestern University has a large site area, the experiment space for each person is overwhelmingly wider than the University of Tokyo, and many usable equipment are also expensive. The former is inevitable because of the land price, but the latter reason is probably due to the deep relationship between laboratories and faculties. In the university in the United States, collaborative research was popular, machine lending and borrowing was very widely done, sometimes it was possible to borrow machines between universities. In Japan, although it is not entirely unknown, is not it rare to lend and borrow machines beyond faculties? There is no doubt among universities. Witnessing the culture of the United States that respects the connection in the horizontal direction, I am keenly aware that Japanese colleges should learn and that I should look to the "outside" of the laboratory.

In addition, American researchers took pride in their own research as a whole and it was clearly seen. Many posters as research introductions and numerous contributions of high impact articles were lined up in the hallway. In Japan, at most one poster is just placed in front of the laboratory. If you take out papers on the wall like the photo in Japan, you may be abused as "being in tune". It is something that can only be done in the United States where “outgoing piles are pulled out”, but the research they are conducting and the research being conducted in Japan are the same top-notch research. It is a point that Japan must emulate. It made me feel excited just by walking in the corridor that was surrounded in such a way that these research results were visible.

[Acknowledgments]

In this overseas training, I touched on world-class research and I was able to look at my own weak points. I would like to thank Dr. Shimada, Dr. Sawada and others in charge of MERIT's staff who organized such training. Also, I thank Professor Stupp, Professor Zimmerman, Professor Moore and Professor Moellering for accepting the visit pleasantly and looking forward to my hopes seriously. And I express my sincere gratitude to the students who took care of me at each laboratory who made this training fun and meaningful.

MERIT 2018 Overseas Training Program Report

Feb. 26, 2018 – Mar. 4, 2018
Northwestern University

Kiyoshi Morishita, MERIT 7th Grade,
Graduate Student, Aida Lab, Department of Chemistry and Biotechnology,
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March 31st, 2018

Executive Summary

From February 26th to March 4th, 2018, a group of University of Tokyo students from the Materials Education program for the future leaders in Research, Industry, and Technology (MERIT program) participated in an overseas training program. The location of the visit was Northwestern University (Evanston, IL, USA) and surrounding schools and research institutes. On the first full day in Evanston, the group was lead on a tour of Northwestern University, with visits to various research institutes. This was followed by a breakout session involving students and researchers from the University of Tokyo and Northwestern University. During the following three days, MERIT students were expected to arrange their own lab visits and meetings with faculty, researchers, and students. The experience of one MERIT student, Kiyoshi Morishita, from the Aida Lab, Department of Chemistry and Biotechnology, Graduate School of Engineering, is detailed in this report. Individually arranged activities included visits to six different chemistry research labs. Overall, the overseas training was a great opportunity to meet and discuss research issues with several world-leading researchers and graduate student peers. This allowed for the development of strong academic connections, and a perspective of research in a leading overseas university, which will undoubtedly inform future career decisions and promote the adoption of a global perspective.

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A large open field and old library building at Northwestern University.

1. Introduction

The Materials Education program for the future leaders in Research, Industry, and Technology (MERIT program) is a Leading University program which supports, financially and academically, University of Tokyo graduate students in materials science-related fields, over the course of their graduate studies. Each year, approximately 40 students enter the program, with the 2017 entry class being the 7th grade of MERIT students. Of these 40 7th grade students, 23 were selected to participate in an overseas training program, financially supported by the MERIT program and organized jointly by the MERIT program staff, students, as well as members of Northwestern University. The overseas training period was February 26th – March 4th, 2018.

This report serves as a complete and comprehensive record of my experience during the MERIT 2018 overseas training program. I have organized the report in a format which, I hope, highlights the activities on each day of the training program and also my impressions and perspectives gained through this experience. It is my sincere hope that this report not only serves as a record of the activities, but also as a guide for future MERIT overseas training students.

MERIT students and staff at Northwestern University, Feb. 27th, 2018.

2. Preparation for Overseas Travel

In preparation for the MERIT overseas training, the MERIT office and the University of Tokyo staff who joined the Overseas training, Lecturers Tomohisa Sawada and Takashi Shimada, hosted two introductory meetings for MERIT students. The first gave an overall introduction to the program, required documents and advice on contacting research groups to arrange lab visits. The second meeting served to provide details on the trip, including weather, safety, schedules maps and contact info. We were warned specifically about safety in Evanston and Chicago, as

well as the cold, -20°C winters in the region. Luckily, neither of these concerns came up during the training period.

In early December, I made contact, along with Shun Suginome, a fellow student in the Aida Lab who joined this year's overseas training, to two alumni from the Aida Lab, Michio from the William Dichtel Lab and Kohei from the Samuel Stupp Lab, who were post-doctoral fellows at Northwestern. They gave us valuable advice in making initial contact with research groups we wished to visit. They suggested that we send an email, not only to the Professor, but also to carbon copy (cc) the Research Assistant professor, Research Administrator, Program Coordinator, and other lab members in similar positions, for the best chance of receiving a reply and setting up a lab visit. Using this advice, along with other effective email habits I've developed (a clear, yet concise explanation of the purpose, actionable request, use of bold and coloured text for highlighting, and proper letter-style formatting), I made contact with several labs at Northwestern to arrange lab visits. I arranged visits to the Chad Mirkin, Teri Odom, and Shad Thaxton labs, with the initiation of contact on 12/16, 1/11, and 1/16 respectively. Michio and Kohei helped to arrange visits to their labs. There was an additional lab which I emailed, on 1/16, however I never received a reply. I did not follow up due to the positive responses from the other labs and a rapidly filling schedule.

Another important step in the preparation for this overseas training was preparing gifts to bring to people at Northwestern. I brought gifts for the professors whose labs I visited, snacks for their students, a small gift for the people (office staff, lab manager, etc.) who I was in contact with to arrange the meetings, as well as for a few other special people at Northwestern. I felt that that was a good way to thank people for taking the time to help me make the most of this training experience. Buying gifts for the members of the 6 different labs I visited, as well as other for other people, as well as co-ordination with other MERIT students visiting the same labs together was definitely a challenging process, but worth the effort.

A beautiful day at Northwestern University.
Lake Michigan can be seen in the distance.

3. Day 1 – Travel to Chicago

The overseas trip began on February 26th, 2018 with the flight from Tokyo Narita to Chicago O'Hare. Due to the time zone difference, the flight took off at 17:30 and landed at 13:05 of the same day, a 10 hour and 35-minute flight. After a bus ride to the hotel, a group of us went for a brief walk around Evanston, which is a small college town in the suburbs of Chicago. We ate deep dish pizza for dinner, which was good, and definitely a different experience than the traditional Japanese cuisine in Tokyo. The first day of travel was quite tiring and I slept early, around 21:00.

Deep dish pizza.

4-1. Day 2 - Northwestern University Visit

On the first full day in America, I woke up early and enjoyed the amazing all-inclusive breakfast at the hotel. Then I spent time on my presentation, researching about the labs to visit and preparing cards and gifts for the day at Northwestern University. Emily Wilson, Director of International Relations at Northwestern came to our hotel to meet us at 9:30 and walked us to our first information session, with information about Northwestern long the way.

Our first session was with Sara Rupich, Chief Scientific Officer at the International Institute for Nanotechnology (IIN). She gave an overview of the Institute and its many commercial activities. I was able to ask her about the ownership of inventions at Northwestern and whether a formal program was in place to accept foreign research internship students, as I may be interested in going back to Northwestern for the Long-term Overseas Research component of the MERIT program. There is no formal system, but the student should contact the desired lab directly, and they would consider on a case-by-case basis.

One of the guides for the first part of the day's tour was Andrea, a graduate student in the Mirkin Lab, who I had met at the 2017 Gordon Research Conference (GRC) on Supramolecular Chemistry. She was very friendly and, after I gave her my business card, we got in contact through

Shun and Kiyoshi at the IIN.

Andrea and Kiyoshi, reunited!

email. She sent a list of her favourite places to go in Chicago and also helped to arrange an additional lab visit the following day for Shun.

The next stop on our tour was the Gianneschi Lab, where we were met by first year graduate student, Ioannina and Project Scientist, Matt, who told us about work in their lab and life at Northwestern. From there, we went to the Dichtel Lab, where we met Michio, and graduate students Austin, Diego, and Michael who guided a lab tour and told us briefly about their research.

Next, we visited the Stupp Lab, where we greeted by Research Associate Professor, Liam Palmer. We were divided into small groups and taken through different demonstration stations set up in the Stupp and adjacent John Rogers lab. Kristen, a first-year grad student in the Stupp Lab, showed us their 3D printer. Hussain, a third-year grad student showed us an atomic force microscope (AFM) with 3-4 angstrom resolution and explained briefly his work on examining the formation and stability of β-sheet stabilized fibers. By measuring the height of the deposited fibers (fiber width), he can see the helical structure of the fibers. In the Rogers Lab, Johnathan, a post-doc showed us various sweat sensors for pH, glucose, lactate or other analytes. These sensors are only powered by the pressure exerted by the sweat glands, which is 2-3 kPa for a single sweat gland. The research group has worked with some professional sports teams, including the LA Lakers, Seattle Mariners, and Chicago Cubs. I was interested to hear how some teams are very secretive about the data on their players, while some teams are very open about the results.

The next tour stop was at the Institute for Sustainability and Energy at Northwestern (ISEN). We were lead on a tour by Ryan Young, Director of Laboratory Research. He showed us the FLEX Lab, which is available to student group, corporate partners, or other groups, with a Northwestern faculty sponsor. The lab is free to use, for a period of 6 months to 2 years, although the selection is based on the applicability of the research to sustainability and energy issues. We were also shown a lab with lasers, which had a carefully controlled temperature, moisture and particulate matter controls, along with vibration isolation tables, all necessary due to the sensitivity of the lasers. At ISEN, following the tour, we were give a presentation by Jeff Henderson, ISEN Associate Director, with more details on the operations.

For lunch, we attended a luncheon hosted by Dévora Grynspan, Vice President for International Relations at Northwestern. Again, the food was great, and we could enjoy chatting with Dévora about many things, for example her obligation to

The MERIT group with Dévora Grynspan.

attend football games so that she does not get left out of the conversation at meetings with the Vice Presidents meetings.

After lunch, we visited the Center for Advanced Molecular Imaging (CAMI), where the Managing Director, Chad Haney, showed us an interactive, custom built display, composed of many individual 3D display panels, on which we could see representations of various biomolecular interactions and image scans of small animals. Next, Alex Waters showed us the experimental facilities, featuring a 9.4 Tesla MRI scanner. This Center provides visualization support for bio-systems to all of Northwestern.

The display at CAMI.

The final stop was at the Northwestern University Atomic and Nanoscale Characterization Experimental Center (NUANCE), where we were given tours by Jann and Akshay, graduate students from the Vinayak Dravid Lab.

After the tour of Northwestern, we attended a breakout session with graduate students from Northwestern and MERIT students. The room was divided by research field, with tables for Chemistry, Physics, and Materials Science. I was at the Chemistry table, but mostly only spoke with Gokay, the manager of the Bio subgroup in the Mirkin Lab. I presented my research to him, with the help of an A3-size poster I brought, and we discussed various research issues, as well as life in the Aida and Mirkin Labs.

Finally, there was a closing reception, hosted by Dévora Grynspan, and her husband, Professor Stupp, both of whom are very good friends with Prof Aida. We mingled with various Northwestern students and staff, and I again used my poster to share my work, this time with Prof. Stupp and with Hiroaki, a post-doc in the Stupp Lab. Prof. Stupp was very nice and ensured that the MERIT students visiting his lab were well looked after, including giving us passes to ride the inter-campus shuttle freely.

Kiyoshi, Prof. Stupp, Shun, Ms. Grynspan.

Finally, after a long day, I returned to the hotel. A group of us went to Edzo's Burger Shop for dinner. I had an award-winning spicy burger which was very delicious. After returning to the hotel, I sent emails, reviewed my presentation slides and read a few papers by Prof. Thaxton, whose lab I would be visiting the next morning. Finally, I slept in the early hours.

4-2. Day 2 Perspectives

Day 2 was very overwhelming with the amount of walking and number of labs visited and people that I met. I'm very thankful that I took many photos and took notes throughout the day. I learned many lessons this day, with the ones which stand out below.

When I asked Sara from the IIN about the presence of a formal process for setting up a foreign research internship at a lab at northwestern, she didn't know the answer, but she replied that she would look into it. I was very surprised and impressed that she followed up with the answer two days later, after a subgroup meeting in the Mirkin Lab, where she also holds a position. She didn't forget the question or the face of the person who asked it! While the question may seem relatively insignificant, looking back, it makes me very happy that she took it seriously. From this I was reminded of the importance of following up in communication with others. What may seem like a small point to one person may mean a lot to another.

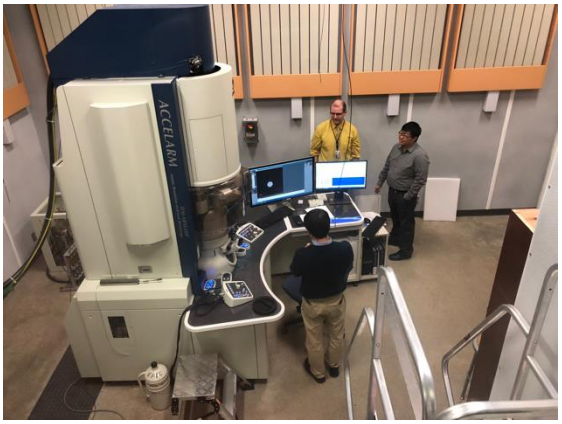
I was also very happy to have recognized and reconnected with Andrea from the Mirkin lab on the first day at Northwestern. She really is super kind and very thoughtful. Actually, at the GRC conference where we met, I got to know her through drinking together and I remember especially fondly enjoying the last night dancing at the nightclub with her. I bring this us to emphasize the importance of networking. Had I not connected with Andrea at the conference, I certainly would not have enjoyed the friendly exchange with her during the overseas training, her Chicago recommendations and connections with a few of her friends. In truth, we can never be certain when, or even if we will encounter a person again, but by making as many connections as possible when the chance comes up, we can maximize the change of benefiting from that connection at a later date. Combined with the previous point, what may start with a connection formed through some small gesture may, in the future, result in a lab visit, as in the case of Shun, an invited conference talk or research article, or even a job offer. We will never know; we can only control the present.

While visiting the Gianneschi Lab on the morning of the 27th, we met Matt. Through a few questions, I could ascertain that he was a Project Scientist, which, considering the size of the lab, makes him the de facto lab manager. As the group was leaving for the next tour stop, I pulled Matt aside and asked him If Shun and I would be able to join a subgroup meeting. Luckily, there was one to be held on Friday morning. After trading business cards, we got in contact to set up the additional lab visit. I'm thankful for having been able to include Shun in this lab visit, but I did not want any other MERIT members to be aware of these plans, as if three or more MERIT students had joined, we likely would not have been able to present in the subgroup meeting, which was strictly limited to one hour in length. My take-away from this encounter with Matt was the power of simply asking a request. This is a lesson found in the Bible, "Ask, and it shall be given you; seek, and ye shall find; knock, and it shall be opened unto you:" (*King James Version*, Matthew 7:7). Put simply, by proactively asking for things that we want, we are much more likely to receive them, rather than waiting for opportunities to come to us.

After she demonstrated the 3D printer at the Stupp lab, I asked Kristen about her typical working hours and how often she gets to meet with Prof. Stupp. Her typical works in the lab from 9:30 – 5pm, although in the first year of graduate studies at Northwestern, classes take up a significant proportion of this time. She gets to meet with Prof. Stupp about 2 times per term. Comparatively, a typical day in the Aida Lab is from 10 am – 11 pm, and we get to present our research progress to Prof. Aida about once per month, in subgroup meetings.

I learned about differences between research in the Stupp and Aida labs. While the two professors are great friends, and both world leaders in the field of supramolecular chemistry, the experience in their respective labs is quite different. I believe a big reason for this difference is the more general academic research culture in America and Japan. For example, in America, they value free time more, and there may be less pressure to work long hours. As a result, I feel that the students in America are in general, more efficient in their work. The duration of meetings is also more strictly controlled in the labs I visited, compare to in the Aida Lab. From this experience, I also became more appreciative of the frequency of chances I get to meet with Prof. Aida.

I was surprised to see the offices of Epicore Biosystems, a start-up company founded by Prof. John Rogers. Their office was located adjacent to the Rogers Lab, and I imagine there is a significant sharing of material and intellectual property between the two groups. This is a great example of a more general observation that in America, professors are more entrepreneurial-minded than their Japanese counterparts. This entrepreneurial mentality is very familiar to me, coming from the University of Waterloo, which promotes its image and reputation as an entrepreneurial university. In fact, I was involved in co-founding a start-up within an incubator system myself. I wish this culture was more prevalent within science and engineering students in Japan, and especially at the University of Tokyo.



Aberration-corrected TEM.

Office of Epicore Biosystems.

The most impressive instrument I saw during the tours on the 27th was a multi-million-dollar aberration-corrected Transmission Electron Microscope (TEM), located at the IIN. In general, I got the impression that research groups in the US have more money at their disposal than at the University of Tokyo. Another peculiar observation was that the room in which the TEM was housed was temperature controlled to exactly 70.00 °F, as visible on a display panel

inside the room. In fact, in the 6 photos I took, over 6 minutes, the displayed actual room temperature did not exceed a 0.1 °F difference from 70.00 °F. It makes sense for the room to be precisely controlled due to the accuracy of this instrument, however, I found it strange that the set point temperature was in Fahrenheit degrees. Of course, America uses Fahrenheit as the room temperature standard, but it is rarely seen as a standard in science.

I spent the day before leaving for the training program in the office at school, preparing a poster of my research to print on A4 and A3 size paper to bring to Northwestern. This was inspired by my observation of a senior student in the Aida lab, Hubiao, who brought an A3 sized poster to a conference earlier in the year. Using this poster, he presented to many of the professors who attended. While they might otherwise not have seen his poster during the limited poster session, he was able to share his work with them. Eventually he won the poster prize at the conference. Thus, I was inspired to create my own poster, as I thought there would likely be opportunities at Northwestern where it would not be practical to use my computer to show visuals. These posters really came in handy, as it helped me to present my project and recent research results to Gokay during the breakout session, Prof. Stupp and Hiroaki during the closing reception, and others throughout the trip. I highly recommend this tip to others in a similar situation. You never know when the opportunity to share your research will come up!

5-1. Day 2 – Individual Plan

On the morning of day 2, I awoke early with anticipation of the individually planned lab visits. After enjoying the delicious breakfast, I checked out of the hotel and took an Uber to downtown Chicago. The first meeting of the day, together with another MERIT student, Rimpei, would be with Prof. Shad Thaxton at the Robert H. Lurie Medical Research Center of Northwestern University. Prof. Thaxton has both a PhD and MD, both from Northwestern. He did his PhD in the Mirkin Lab and published many papers in top journals in the same field as my research. Now his research is on high-density lipoprotein nanoparticles for therapeutic applications. Through my preparative research on Prof. Thaxton, I found that Prof. Mirkin once said of Prof. Thaxton, "I call him a Michael Jordan," "he's not only fantastic, but he makes everybody else around him better." Thus, I was very eager to meet this superstar young researcher.

Through my research, I also found a blog post in which somebody told a story of Prof. Thaxton taking their group to Starbucks. Thus, I thought it would be a great idea to get a cup of coffee for Prof. Thaxton on the way to meet him and, at least he seemed, very appreciative. We met Prof. Thaxton from 10:00 – 11:00 and I was able to present my research, get valuable feedback, and ask him many questions about research and career issues. One great piece of advice that he gave me was that if I want to be in a clinically-minded environment, rich for potential collaboration, evaluating the clinical relevance of my ideas and developing new research directions, the onus is on me to visit the University of Tokyo hospital and medical school and develop a relationship with researchers there. As a result of this advice, I have started reaching out to researchers at the medical school and hope to build some solid connections.

After the meeting with Prof. Thaxton, he introduced us to a few of his lab members. Post-doctoral researchers John, Kaylin, and Rohun each sat down with us and discussed research issues, showed us around the research facilities and answered our many questions about life in the Thaxton Lab. From 13:30 – 15:00, we went for lunch at a nearby Cuban restaurant with Rohun and Matt, a graduate student in the Thaxton Lab.

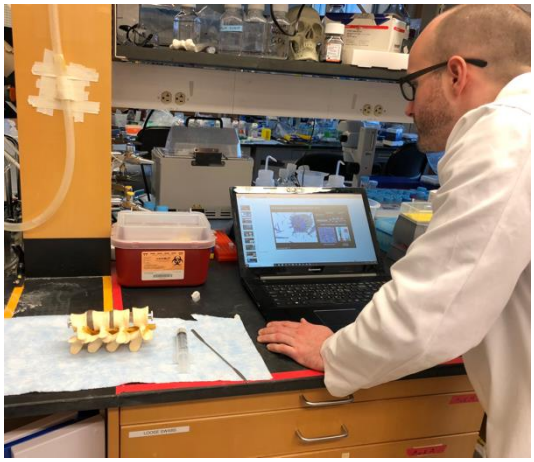
Rimpei, Prof. Thaxton, Kiyoshi.

After returning to the Lurie building, Rimpei and I joined fellow MERIT students Shun and Yuki and together we visited the Stupp Lab at the Simpson Querrey Institute for BioNanotechnology (SQI), also in the Lurie building. The Stupp Lab does research on the controlled supramolecular assembly of peptide amphiphiles and therapeutic application. We were met by Liam, who gave us a tour of the facilities.

On the tour, we met Mark Karver, Director of the Peptide Synthesis Core, who told us about the peptide synthesis capabilities at SQI. They can make a 10-amino acid peptide in one hour through microwave-assisted synthesis, a task that would take a graduate student one week by hand. They mainly provide services to members of SQI, however they offer services to the greater Northwestern University campus and even the rest of the world.

We also met Mark McClendon, Translational Research Officer, who gave us a demonstration of an injectable, bone-healing paste developed in the Stupp Lab. He also told us about his work in assisting SQI researchers in taking their developments through the regulatory process and into commercialization. It seems great that the SQI has a person specializing in this type of translation to work directly with the researchers.

After leaving the Stupp Lab and SQI at 16:30, Rimpei, Yuki, and I took advantage of the remaining daylight hours to walk around downtown Chicago. We visited the AT&T Plaza at Millennium Park, home of Cloud Gate, the famous bean-shaped sculpture which was at the top of my to-see list in Chicago. I am very grateful to have seen this, as my free time in Chicago was very limited. Next to the sculpture was an outdoor skating rink, where was saw a peculiar and amazing sight. A short, balding, middle-aged man gracefully figure skating, with jumps, spins, and all! For dinner, a group of MERIT students went for deep dish pizza, again, which was very delicious. Afterwards, I took the inter-campus shuttle back to Evanston, where I checked in to a new hotel, sharing a room with Shun. I was very tired from the day and fell asleep right away.



Translational research at SQI.

Yuki, Kiyoshi, Rimpei at the Cloud Gate.

5-2. Day 3 – Individual Plan

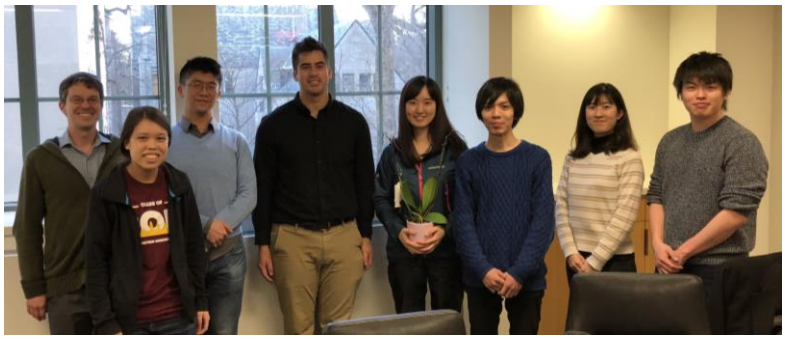
On day 3, again I woke up early with excitement. At 9:30, Shun and I went to the Northwestern campus to visit, along with Rimpei, the Chad Mirkin Lab. Prof. Mirkin is "a chemist and a world-renowned nanoscience expert," and, also from the lab website, "a Prof. of Chemistry, Prof. of Chemical and Biological Engineering, Prof. of Biomedical Engineering, Prof. of Materials Science & Engineering, and Prof. of Medicine," at Northwestern. He is, "the director of the IIN and founder of four companies," he, "served as a Member of the President's Council of Advisors on Science & Technology (Obama Administration) for eight years, and he is one of very few scientists to be elected to all three US National Academies (Medicine, Science, and Engineering)." In short, he is a superstar in the field and his lab is one of the top in the world.

We were greeted by the Lab Manager, Tanushri, who I had been emailing to arrange this lab visit. We first talked in her office about life in the Mirkin Lab. I was impressed that the lab has 65 members, including a lab manager, scientific officer, business manager, and other research and administrative staff. Tanushri then guided us on a tour of the Mirkin Lab facilities, which take up the entire floor of the building. We then sat in two subgroup meetings. The Dip Pen Nanolithography (DPN) subgroup, which does research on a technique pioneered by Prof. Mirkin held a meeting from 10:00 – 11:00. The first half of the meeting involved a discussion about the specifics of a new instrument to buy. Then one student presented their research update. The next meeting, from 11:00 – 12:00 was with the Organometallic Chemistry subgroup. Rimpei and I introduced ourselves, or research, our labs and the MERIT program very briefly with the help of a few slides. Then Shun presented his research in the first half of the meeting, followed by a member of the Mirkin Lab. After the meetings, we again discussed with Tanushri, who was very patient in answering all of our questions.

From 13:00 – 13:45, I met with Prof. Teri Odom, a nanomaterials and photonics expert. I presented my work to her with the help of slides and my poster. She gave me some great comments and suggestions for my research. She also gave me great advice and offered support for a conference I wanted to attend, a point which is elaborated on in the Perspectives section below. Unfortunately, the meeting seemed to pass rather quickly, and Prof. Odom arranged for a post-doc in her lab, Roger, to give me a lab tour. I saw all of the lab facilities, including a differential interference contrast (DIC) microscope, which is used to enhance to contrast in optical imaging of unstained, transparent samples. I then discussed about research and life at northwestern with Ted, who works on metalenses, and Dongjoon, who works on controlled surface wrinkling.

From the Odom Lab, I went to the Stupp Lab at the Evanston campus for a meeting from 15:00. Fellow MERIT students, Shun, Rimpei, Takako, and Chizuru attended this meeting, where we each presented our research to a few members of the Stupp lab. Following this, we were guided on a tour of some of the shared facilities available to the Stupp lab, by Hiroaki and Kristen. The highlight of this tour was the nuclear magnetic resonance (NMR) facility, which housed 10 NMRs, one of which was cut open to show the inner components.

After this tour, Hiroaki walked us through campus, showed us the chapel, and took us for dinner at Farmhouse, a nice restaurant in Evanston. By this point I was very hungry, as I had not had time for lunch. After dinner, we visited Barnes & Noble and Whole Foods to buy some gifts to bring back to Japan. Again, I was very tired from the day and went to sleep at around 21:00.



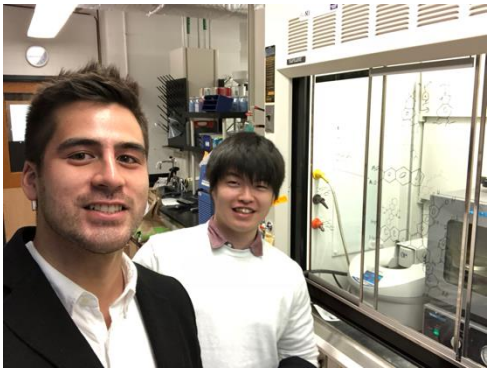

Left: Liam, Kristen, Hiroaki, Kiyoshi, Takako, Rimpei, Chizuru, Shun. Right: Dinner with Hiroaki.

5-3. Day 4 – Individual Plan

Day 4 started with a visit to the Gianneschi Lab, organized during the trip. The Gianneschi Lab does research on soft matter, biomaterials, and nanoscopy. The lab moved from the University of California at San Diego in July 2017 and has already doubled in its number of members. Shun and I joined in the Materials subgroup meeting, from 9:00 – 10:08, which was smaller than in the Mirkin lab, at only 12 members. Shun and I both presented our research and got great questions, comments, and suggestions. Then there was presentation by a member of the Gianneschi Lab. Following the meeting, Matt, the Project Scientist, gave us a tour, walking

through the lab, which we did not do on the first day at Northwestern. He then patiently discussed with us issues concerning the experiences of students and staff in the Gianneschi Lab.

After the visit to the Gianneschi Lab, we took a break and then, at 11:30, met with Michio, the Aida Lab alumnus now working in the Dichtel Lab. Michio treated us to lunch and lead us on a campus tour, during which we discussed a range of issues, including his new life in the US, how it is different than Japan. We updated him on new developments in the Aida lab and he gave us valuable career advice, specifically if we want to work in America. Afterwards, Michio took us around to various labs in the Department of Chemistry and introduced us to several of his friends. Afterwards, I used my poster to share my research with Michio and also gave him a copy to share with Prof. Dichtel. Prof. Dichtel was busy during that time, although I was able to stop and chat with him for a minute or two in the hallway.



Kiyoshi and Shun in the Dichtel Lab.

At 14:00, I left the Dichtel Lab, and went back to the Mirkin Lab. As my meeting with Gokay was scheduled from 15:00, I sat in the lounge area in the Mirkin Lab and took the free time to send follow-up emails to Prof. Thaxton, Mark McClendon, Tanushri and Prof. Odom, whom I had met on previous days. I met with Gokay from 15:07 - 15:48, during which time he outlined all of the current projects and future research directions of the Mirking Lab Bio supgroup. He also answered my numerous questions about research and life in the Mirkin Lab. After the meeting, I went to say farewell to Tanushri, although she is very friendly, and we ended up chatting for 35 minutes about Prof. Mirkin's schedule, her motivations for working as the Mirkin Lab Manager, and the life of a graduate student.

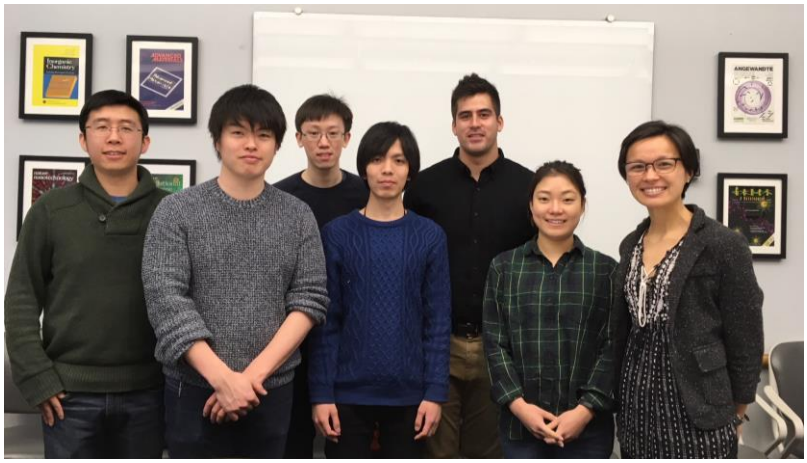
Finally, I left the Northwestern campus and bought a few more gifts in Evanston. For dinner, I went with Takako, Chizuru, along with Hiroaki, to the Peckish Pig restaurant. Afterwards, I went to a bar and enjoyed a beer with Hiroaki, where we discussed about research life and career perspectives. Afterwards, I retreated to my hotel, very tired from the long day, and fell asleep without packing my bags.

5-4. Day 3 – 5 Perspectives

I was very impressed by the scale of the Mirkin Lab. The lab has 65 members, which is about double that of the Aida lab at the University of Tokyo campus. However, the lab space was about 4 times the size, not including shared facilities. Additionally, the Mirkin Lab has many scientific and non-scientific staff. While Prof. Aida's office is a small room which also has two secretaries, the Mirkin "office" has a reception area, staff offices, and a small meeting room, in addition to the professor's office. Seeing this really opened my eyes to the difference in funding

and space allocation to top labs in America versus in Japan. This will certainly be considered if I decide to pursue an academic research career.

In the Mirkin Lab DPN subgroup meeting, the students and staff were debating which plasma cleaner/etcher to buy. I was impressed that most members were contributing to this discussion. For one, it showed that all members had done research and were seriously considering all aspects of the decision, including the power source and space requirements, functionality, cost, etc. I got the impression that once a consensus was reached, they would have to justify this decision to Prof. Mirkin. Also, it was great to see that all members, even graduate students had a say in the decision, instead of the decision being made by a small group of senior staff members.



Shun, Rimpei, Kiyoshi and members of the Mirkin Lab.

In the Mirkin subgroup meetings, I was also surprised that the presentation was often interrupted by a discussion. There was no discussion period after the presentation, as everyone was expected to ask questions or make comments during the presentation. This lead to a very high-paced and active discussion. I was also surprised by one exchange, where a senior staff member grilled a junior grad student about their lack of new research results and slow progress. At times the atmosphere was very serious. Additionally, the meeting duration of one hour was strictly enforced, with one member in the first meeting not being able to present as the discussion about the new instrument had taken too long. Both of these points make the Mirkin subgroup meetings very different in style to those in the Aida lab, where each member presents in an uninterrupted presentation, followed by a discussion period, and the meeting typically lasting about 6 hours, with a meal break. The Mirkin Lab has subgroup meetings once a week with one or two students presenting, meaning that each student can present their updates once every 3 months. Whole group meetings with Prof. Mirkin are held every 10 months. Meanwhile, in the Aida Lab, the subgroup meetings are held once a month, with Prof. Aida attending, and each student has the chance to present once a month. Whole group meetings are held twice a year. I can't say whether one system is better than the other, however, it is clear that there are many different ways to run a research group!

When meeting Prof. Odom, I brought up a conference that I wanted to attend. Through my prior research, Prof. Odom will be presenting at this conference. As the conference is quite small, it is difficult for graduate students to get accepted. Following my previously mentioned perspectives on networking and asking for what you want, I asked Prof. Odom if there was any advice she could give me or any way she could help me get into the conference. She agreed that the research that I had presented to her was of sufficient quality to present at the conference and told me to include her name in my application and to contact her when I had submitted my application and that she would contact the conference chair. I am not sure whether she ever did contact the chair, but I did eventually get accepted to attend this conference and will be attending in June. Again, it helps to make connections as you never know when they can help you and it is good to ask for what you want.

The inside of an NMR.

Through seeing the shared research facilities available to the Stupp Lab, and especially the NMR facility, I realized one, the amount to funding for research in America, and two, the collaborative nature of research across the Department of Chemistry and more broadly, Northwestern University. This was also evident when I walked around with Michio to meet his friends. He just walked in to the offices of the other research groups and asked if his friends were around. This free access between student offices is non-existent in the Department of Chemistry and Biotechnology at the University of Tokyo. I really desire to work in an environment where collaboration within the same research group, within the department or the school is encouraged.

Finally, I was struck, when discussing, first with Tanushri, and then with Matt from the Gianneschi Lab when I asked him about his career aspirations. Where did he want to end up after his position in the Gianneschi Lab. He has been a member of the lab almost since its inception, first as a post-doc and now as a project scientist. When asked, he replied that he was not looking to achieve any higher position. He's happy where he is and in his job. This position is really quite simple, but it was a bit of a surprise to me, as I had previously assumed that for a career in academic research, the only option was to become a professor. I realized that this is not the only option, and due to a variety of circumstances, a seemingly "lower" position may be a much better fit. I will remember this when considering future career opportunities.

6. Day 6 – Return to Tokyo

Our return flight to Tokyo was on the morning of March 3rd. Because I had not started packing yet, I woke up at 4:37 and began. Shun and I checked out of our hotel at 7:00 and took an Uber, arriving at O'Hare international airport at 7:34. After checking in and buying a few more

things, we boarded, with the flight taking off at 10:48. The return flight was against the wind, this time taking 12 hours and 50 minutes, but soon enough we were back in Japan.

7. Perspectives

I really enjoyed the experience at Northwestern University! I had a productive time with many lab visits and meetings in a short time period. I learned about differences between research in America and Japan. For example, in America, they value free time more. The duration of meetings and the working day are shorter, and more strictly controlled in the labs I visited. I also learned about the importance of networking. I was able to set up additional meetings just by talking to people who I met. I hope I can connect, in the future, with people that I met at Northwestern. Overall, this was a great experience and I will now seriously consider studying abroad or working in America for an internship or after graduation.

Cloud Gate in downtown Chicago.

8. Acknowledgements

This overseas travel experiences would not have been possible without the tireless contributions of several people. First and foremost, I must thank the MERIT program for the financial support for this overseas travel. The MERIT staff worked had to ensure the complete planning and smooth operation of this trip. Especially, the work done by Professors Sawada and Shimada, who ensured we were well prepared and safe before, during, and after the trip, must be acknowledged.

The Northwestern University Office of International Relations also did tremendous work in the facilitation of Northwestern as the location of our overseas training program, and in ensuring an enjoyable and enriching experience. Director of International Relations, Emily Wilson, came to meet us at our hotel and directed us on the Northwestern University campus throughout our entire day on Day 2.

I must also acknowledge Dévora Grynspan, Vice President for International Relations, for her hospitality in hosting a luncheon on Day 2. I also want to thank Sara and Tanushri from IIN, Andrea from the Mirkin Lab, Ioannina and Matt from the Gianneschi Lab, Austin, Diego, Michael, and Michio from the Dichtel Lab, Liam, Kristen, and Hussain from the Stupp Lab, Johnathan from the Rogers Lab, Ryan and Jeff from ISEN, Chad and Alex at CAMI, Jann and Akshay from the Dravid Lab and NUANCE, as well as all of the Northwestern students who took part in the breakout

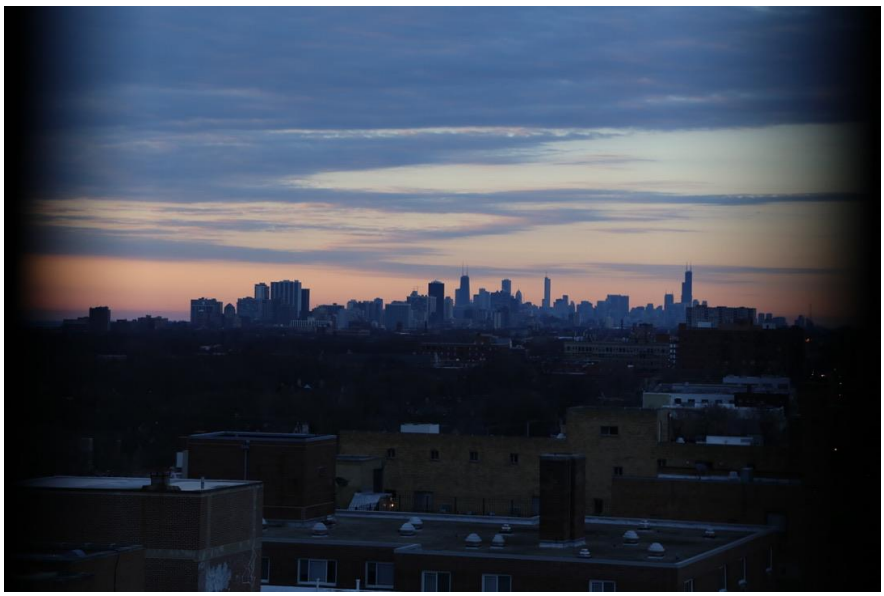
session. They all took time out of their schedules on the 27th to speak with us, give us tours or demonstrations.

During the individually planned days, John, Kaylin and Rohun from the Thaxton Lab, Liam, Mark, and Mark from SQI, Tanushri from the Mirkin Lab, Kent, Jingshan, Andy, and Gokay from the Mirkin Lab, Roger, Tingting, Ted, and Dongjoon from the Odom Lab, Liam, Kristen, Hussain, and Hiroaki from the Stupp Lab, Ziying from the Gianneschi Lab, and Michio from the Dichtel Lab, all took the time to give me a tour, explain their research or listened and gave feedback to mine. A very special acknowledgement to my friend Andrea who sent her recommendations of top "Chicago Adventures", and also helped to arrange additional last-minute lab visits.

I must thank Northwestern Professors Sam Stupp, Shad Thaxton, Teri Odom, and Will Dichtel, Chad Mirkin, and Nathan Gianneschi who facilitated lab visits, and/or took time out of their very busy schedules to meet with me and give valuable advice for my research and career.

Also, very contributive to my experience were Kohei, Liam, Laura, Maura from the Stupp Lab, Rohun from the Thaxton Lab, Tanushri and Gokay from the Mirkin Lab, Matt from the Gianneschi Lab, and Michio from the Dichtel Lab, who all showed great patience in our contact back and forth to set up lab visits. A big thank you as well to all of the lab members of the Thaxton, Stupp, Mirkin, Odom, Gianneschi, and Dichtel labs for allowing me to tour through their labs, participate in their group meetings, or otherwise.

Finally, I must give a special thanks to my own advisor at the University of Tokyo, Prof. Takuzo Aida, for pushing me to join the MERIT Program, allowing me to take a week from the lab to join the overseas training, and for acting as a great connector in setting up this training program in its early stages.



Sunrise view of Chicago on the last day. A fitting goodbye to a wonderful experience.

MERIT Overseas training Report

Department of Physics Jun Usami

[1st day]

I visited Prof. Halperin Lab. Here are two experimental groups, Low Temperature and NMR. They study ^{3}He and superconductivity. They make Aerogel and superconductor single crystal by themselves. I don't do sample making and it was inspiring. The single crystal is used in neutron scattering also. They showed me the NMR sample. Though I hear that cryo-free refrigerator is mainstream, there are refrigerant ones and the conditions of experiment looked not so different. However it is better that there are some Ph. D students and they discuss each other. The number of low temperature Lab is decreasing. In such situations, they are collaborating beyond the field such as superconductor for accelerator. One more better point is that there is a theoretical group studying helium or superconductivity and they communicate with each other.

[2nd day]

I visited Prof. Chin Lab. They study cold atom gas experiment. I wanted to see the Lab of cold atom gas, another kind of condensed matter physics. They explained very carefully and the studies are very interesting. Their studies are related to not only condensed matter physics but also nuclear physics. It is very interesting that they can do the experiment in various systems because of the controllability of the optimistic system. I also met Prof. Leggett in this noon. I could talk about my study, but there were some point I could not explain well or understand well. I would like to study more and discuss clearly in the next time.

[3rd day]

I visited Prof. Sauls group. This is the theoretical group studying helium and superconductor. I joined the seminar and heard what they study. One of them talked to me about the vortex in 3He. I didn't know well but it was very interesting. Prof. Sauls is interested in my study, so I'm looking forward to discussing after getting some results.

[Overall]

All groups accepted my request to visit and it was very good experience. Though I heard that the professor doesn't stay their lab, all professors I met this time were very kind and take contact with students. In the view of the study there seemed to be few different point from Japan, however it was better that there were some Ph. D students and discuss with each other. All of them were very eager to study. I was impressed to study more than ever.

[Acknowledgements]

I would like to thank Prof. Shimada, Prof. Sawada, Prof. Kawasaki, Prof. Ichikawa and MERIT office

for supervising, organizing and support. I thank to student leader and subleader. I would also like to express my gratitude to Prof. Halperin, Prof. Chin, Prof. Leggett, Prof. Sauls and their group members for accepting my visit.

Department of physics
Takase Shimizu

I got new points of view for my study life through this MERIT overseas program. Particularly noticed by visiting Northwestern University and the University of Chicago are the detailed consideration for efficient progress of research, outside appeal for grant, and the lack of Japanese presence.

As for the first point, each laboratory room is cleaned and well organized and I noticed their attitude toward placing only related equipment for their current research. Also, there are sufficient amount of lights in the rooms. These are looks trivial but significant for work efficiency and motivation.

As for the second point, their buildings have intriguing interior, which probably intend for catching good students, and some laboratory rooms are designed to appeal visitors. For example, IME has unique cafeteria named “Quantum Café” which has cute illustration of Schrodinger's cat at the entrance (Fig.1). Such sense of fun which makes us feel close to physics may attract not only high-school students but also undergraduate students seeking their future laboratories. Also, their clean room, which of course has huge space and state-of-the-art equipment, is glass sided so that visitors can see inside without wearing clean suits. It is likely that they need to promote their research clearly to the public because their research fund owes private company and donation. Private research fund is now required even in Japan so I found that we need to study their way.

As for the third point, I could hardly see any Japanese students at the two universities compared to the other Asians. I noticed it especially at cafeteria. For example, I saw several case that American joined Chinese group and enjoyed talking in English. Although the student who let us to his laboratory when I visited awchalom group at IME was Japanese, I didn’t meet any Japanese student in other case. Actually, the brochure I got at Northwestern university says that half of international students consists of Chinese, and then followed by Indian and Korean. When I imagine that they discuss in English and study at great environment, I could not but feel the sense of crisis over Japanese students and the need to have research experience outside Japan as my career.

Fig.1 Quantum café at IME

Report for MERIT Overseas Program

Dept. of Physics 1st grade of Master course
Masashi Hosoi

We travelled around Northwestern university, the university of Chicago, and the university of Illinois Urbana-Champaign for the MERIT oversea training from 26th, Feb. to 4th, Mar. We visit experimental facilities and discussed research issues with students in each university.

【2/27 Visiting Northwestern university】

For the first day of visit, we all visited Northwestern university. They have research facilities specialize to nanotechnology and we learnt the history of establishment and visit some facilities. In Japan, we tend to come up with nanomaterial or nanodevice about nanotechnology. However, they regard communication with the society as important and it was surprising for me that they try to apply nonotechnology to environment or energy problem. I learnt a lot of thing there because we visit chemistry or biochemistry group this time, so the contents of reseach is not similar to mine. Although I rarely enter experimental facilities because I am theorist, I felt the space between devices is larger compared to that of laboratory in Japan.

In the afternoon, we had an oppotunity to discuss with students of Northwestern university. It was the first time for me to discuss my research issue in English except for MERIT colloquium. Though I asked a lot of things about my research theme because of its frank form of discussion, it was very regrettable that I could not deliver all of things that I wanted to tell due to the lack of my English ability. Since the oppotunity to discuss physics in English increases in the future, I want to overcome my wealkness in English.

【2/28 Visiting P. B. Littlewood group, the university of Chicago】

I visit Prof. Littlewood in the university of Chicago, who research BCS-BEC crossover theoretically. We did not have the plan for visiting, but they offer me the oppotunity for seminar. Thus, I gave the presentation about my research issues and discussed for one and half an hour. In spite of the difference of research theme, they asked me many quedtions actively, so our discussion became beneficial. After that, I heard their research theme about nonequilibrium exciton-poraloton system. It was very intriguing for me even though it was rather new to me. Recently, I am interested in the analysis of nonequilibrum systems such as transport properties and I thought I have to master the technique used in the seminar.

After the seminar, we went lunch together and talked about their daily life or sightseeing spot around Chicago. Especially, it was surprising for me that it is usual that it takes 6 or 7 years to get Ph.D. Also,

it is enviable that the society evaluate correctly people who got Ph.D.

In the afternoon, I have the chance to visit laboratory of quantum information experiment via the student in Littewood group. Though I do not know about quantum information so much, their explanation was easy to understand and I could understand their research theme to some extent. After that, other group members came to me and talked various things. I spent very fruitful day from the first day of free time. I thank Dr. Hanai and Prof. Littlewood so much who took much care of me during my short stay in this group.

【3/1 Visiting Prof. Cooper, the university of Illinois Urbana-Champaign】

I moved to Chanpaign, about 200km away from the center of Chicago and visit Prof. Cooper, who tackles the Raman scattering experiment, with Ms.Tang, Mr.Hayashi, Mr.Yamashita, and Mr.Sato. The train Amtrak which connect between Chicago and Champaogn is famous for its being delayed frequently. Actually, we arrived in Champaign one hour later from the plan and had to hurry to the university.

The apparatuses are improved to make it possible to measure Raman scattering in various situations. Therefore, they can measure phenomena that is difficult to measure in Japan. Although this experimental method is deeply related to my research theme, it was the first time for me to see these apparatuses and this chance was beneficial for me. In addition, we visit other laboratories which deal with ARPES or photoemission spectroscopy. Though all of those experimental equipments were new to me, it was a good oppotunity to know how the physical phenomena observed which we discuss only in the paper or computer.

Moreover, Prof. Cooper took much care of us and drove us to the hotel. I thank him so much for helping my spending exciting time in Champaign.

【3/2 Visiting Prof. Ryu group, the university of Chicago】

We went back to Chicago thisday, and visit Prof. Ryu with Mr.Hayashi and Mr.Takeshige. We heard about the topoloical phases including many body effect that he tackle for a long time and the differece of environment for research between Japan and the US. I had thought there is almost no difference for theorists, but we heard that it became important that who belonged to the same place.

Also, I unexpectedly had the oppotunity to meet a friend who stay in Ryu group for the program of ISSP. It was exciting to talk with him because he experiences the research in foreign country.

【Acknowledgement】

I felt my ability of speeking or listening to English is lacking through this overseas training. I want to make use of this experience in the future because the oppotunity to discuss physics in English will increase in the coming research life.

Ffinally, I would like to thank for everybody who is involved in organizing this program.

MERIT Oversea Program Report

School of Science, Department of Chemistry, M1 Takahiro Doba

2/27 Northwestern University

I visited Northwestern University with other MERIT group members. We visited many laboratories and the most interesting was the session we had with the students and postdocs. There were many researchers from different backgrounds and I thought this could contribute to the diversity of research.

The main gate of Northwestern University

2/28 Guangbin Dong lab (Chicago University)

I took Uber from Northwestern to Chicago in the morning and visited Gaungbin Dong laboratory afternoon. Guangbin Dong laboratory is famous for C–C bond activation and has striking productivity. Professor put weight on having discussion with his group members and this is different from the style in Japan because we usually have discussion with associate professor. Fortunately, I had a chance to join a research seminar held in the lab. It was interesting that the seminar of total synthesis by the total synthesis group was also helpful for the members in the reaction development group.

3/1 Cristina White lab (Illinois University)

I took a train from Chicago to Urbana-Champaign in the morning and visited Christina White laboratory afternoon. I was impressed to know that they not only optimized the reaction conditions but also the substrate for the reaction when they search for a new reaction. Even if the first report was for a specific substrate, there will be a possibility to widen the scope in the future by modifying the reaction condition. After I had discussion with prof. Christina White, she asked me to come to her lab as a postdoc, which will be a great opportunity in my academic carrier.

3/2 Scott Denmark lab(Illinois University)

In the morning, I visited Scott Denmark laboratory, which is in the same department as Christina White laboratory. Professor is interested in the mechanism of the reaction such as Siziki-Miyaura cross-coupling, and has many impressive publications on this field. When we try to find a new reaction, we tend to put as many reactions as possible without careful thinking, but they were all putting reactions based on the mechanism they studied before. They have been also working on AI for more than ten years and now they can predict the yield and ee in high accuracy without doing an experiment. This made me think how humans can survive in the field of chemistry in the future.

Finally I succeeded in obtaining new ways of thinking through this oversea program. I would like to thank all the people who were involved in this program.

MERIT oversea program report

Sci. Chem. M1 YAMASHITA Keishiro

I joined the oversea program held by MERIT from Feb./26th/2018 to Mar./4th. This the report of the visits of some research institutes around Chicago and Evanston in USA.

[2/27 (Tu) Northwestern university @Evanston]

We all visited the International Institute for Nanotechnology, Simpson Querrey Institute for BioNanotechnology, and Institute for Sustainability and Energy in the first day of the program as scheduled. I was mostly impressed by the corporation with companies, which affects the budget and the practical research theme: e.g. tiny physical condition marker and UV checker with sophisticated design to wear in daily life. This perspective inspired me for I tend to mainly focus on the reason and its meanings of the effects whereas they seemed to do on what people want and how they can achieve.

[2/28 (W) Argonne National Laboratory @ Lemont]

I visited professor Wang at Advanced Photon Source (APS) in Argonne National laboratory on the second day as the first day of the free schedule. I have interests on the atmosphere of the foreign research institutes and their experimental setups. They have larger working space than those in Japan such as KEK and J-PARC, where we sometimes conduct experiments. Wang's group has 7 instruments for measurement with synchrotron radiation beam. They equip generic setups and are shared by many scientists.

I had the opportunity to present my research and discussed it with the group members. That was great experience to notice the problems in the communication and to obtain idea for further research whereas we tend to think and communicate based on the common sense of Japanese even in English conversation in Japan.

[3/1 (Th) Illinois 大 @Champaign]

I visited professor Cooper, Illinois University at Urbana-Champaign with some members of the program on the next day. I wanted to talk with the researchers in different research field. We discussed our own research with professor during lunch. He investigates the physical properties related to the superconductivity and magnetism which are not familiar to me. On the other hand, they used similar research techniques such as DAC, Raman, and cryostat with our lab. Such experiments was impressing so that I would have various aspects to analyse the experimental data.

[3/2 (F) Northwestern 大 @Evanston]

I visited professor Jacobsen and Bina on the last day of the program. Their main target material is water in minerals. I talked with some students in the lab about each research. Fortunately, I attended the seminar where professor Liu, Missouri University, presented. The seminar room consists simply only with chairs and brief reception was held after the seminar. They seemed to talk with at ease in the seminar and the reception.

【Summary】

Each research institute has wide space and freedom. I had seen some students talking to each other on the grasses in the garden in sunny day. Many companies corporate with the universities. Students can freely join training programs by using the shared apparatuses. These are perhaps the background of the activities.

I thought that the main boundary for the conversation in English was the experience to use English, which would be enhanced by shyness of Japanese. I felt the difficulty in listening and speak mainly in the tiny conversation which needs the fluent correspondence continuously.

I hope that the experience in the experience during this program would positively affects us.

【Acknowledgements】

I greatly appreciate professor Sawada and Shimada for their assistance during the program and professor Wang, Cooper, Jacobsen, Bina and lab members for their warm reception. I also thank all the persons concerned with the program.

MERIT Oversea Program Report

Graduate School of Frontier Science,
Department of Advanced Material Science,
Tang Nan

During the Oversea Program, I visited Professor Pallab Goswami from Norhtwestern University, Professor S. Lance Cooper from UIUC, and Professor Gregory Macdougall also from UIUC. It was my first time to the U.S and everything looked new and fun.

—The 1st day
@NorthWestern University, Department of Physics and Astronomy,
Assistant Professor Pallab Goswami

I was not able to decide my first day plan because I did not get any responses from the professors I sent email to. I asked my supervisor, Professor Nakatsuji for help, and he introduced me to his collaborator Professor Pallab Goswami. Prof. Goswami is a theorist and he studies about topological phases of matter and quantum phase transitions and so on. I thought he could be the best person to help me to explain my experimental result. Prof. Goswami is so caring that he arranged three other professors to discuss research issue with me. Thanks to him, my first day in NU was the most hectic day during the whole stay. The first professor Prof. James Sauls, studies low temperature physics, and studies about physical properties of He3. He was very patient with my beginner level questions, and explained in simple words so that I can understand. The second professor, Prof. Nathaniel Stern mainly studies about quantum optics and his student toured me around the lab, showed me their apparatus. The third professor Prof. Danna Freedman is from Department of Chemistry, and she said she is interested in spin ice materials so I gave her a brief presentation about what I am doing. She asked me several questions and I learned a lot from her questions.

At lunch, I had buffet with Prof. Goswami on campus, and the food was very delicious. He also took me to dinner and drove me back to the hotel at night. I was very touched, and I definitely had a great day at NU.

－The 2nd day
@University of Illinois (Urbana-Champaign), Department of Physics
Professor S.Lance Cooper

I visited Prof. Cooper in UIUC with 4 other students. Prof . Cooper is the Associate Head for Graduate Programs, so he said he has been very busy with administration. In Cooper Lab, they grow geometically frustrated materials, and then apply field- and pressure-dependent optical spectroscopy to study orbital- and spin-disordered phases in several classes of materials. His student Eddy showed us around. Prof. Cooper is a very considerate and caring person. He asked about the plans we have and drove us to hotel/station one by one.

In the end, he said he looked forward to collaborating with us one day, and I hope this can come true some day.

―The 3rd day

@University of Illinois (Urbana-Champaign), Department of Physics

Professor Gregory Macdougall

Professor Macgougall studies Magnetism, and also grow novel materials and characterizes them. Me and other two students from MERIT toured around and saw the apparatus: Floating Zone furnace, Box furnace, X ray machine, MPMS, PPMS and so on. I again realized that ISSP is a great place for research, since we have so many great apparatus and open atmosphere as well.

I want to thank everyone who made this project happen. Although it took much more time than I expected for VISA application Professor Ichikawa and Staff from MERIT office supported me till the VISA is issued. I also want to thank Shimada Sensei and Sawada Sensei for guiding us before and during the program. It became an unforgettable experience for me, and I believe, also for all of the students who participated

The Report of MERIT Oversea Program

Dept. of Adv. Mater. Sci., Yutaka Iwasaki

Introduction. There are several greatest thermoelectrics lab. in the Northwestern University. In this time, I have visited Snyder Group in 2/28 and 3/2, Kanatzidis Group in 2/28, and Wolverton Group in 3/1. Detail is written as follow.

1. Snyder Group have investigated new types of thermoelectric materials such as zintl phase compounds and the strategy of further improvement for novel thermoelectric materials such as chalcogenide compounds, skutterudite compounds. As mentioned before, targets of the study in this group are extremely wide. In terms of equipment, Snyder's group seriously take account of overestimation/underestimation of measurements. There are some hand-made measurement system which can measure some properties accurately. Now, they are thinking the quantitative methodology of some kinds of thermal properties which is difficult to be evaluated. As a whole, member of Snyder's group consider critical point of thermoelectrics scientifically. I understand the reason why this group can lead the trend of thermoelectrics. Since I sometimes realized my lack of knowledge when I discussed with them, I hope to utilize some concept that I leaned in this lab.

2. Kanatzidis Group have found some extremely high performance thermoelectric materials and have investigated several novel strategy to realize high performance thermoelectric materials. Furthermore, Kanatzidis group have also investigated many kinds of inorganic materials such as perovskite solar cells, gamma ray detector materials. I was surprising that there were a lot of equipment in the lab. While each commercial properties measurement system which is expensive are only one, they have three machines. There were also a lot of furnaces and glove boxes. Prof. Kanatzidis must get big budget and be the greatest inorganic chemist.

3. Wolverton Group is a laboratory of computational material science, and they have performed a wide range computational study such as physical property prediction using first principles calculation and Materials Informatics (MI) which is applied information science to material science. Although they were a computational group, there were no facility other than a workstation, but the Wolverton Group manages the materials database called OQMD. This database contains phase diagram many materials which has not been experimentally prepared but is thermodynamically stable by first principles calculation. Some materials that were predicted to be stable by first principles calculations was found by experimental group. Mr. Jiahong who have taken care of me is also studying new complex anion compounds by high throughput calculation. Since some researchers are also researching thermoelectricity, I learned something that can be utilized in my research.

Acknowledgement. This oversea program was financially supported by MERIT. I thank Dr. Tomohisa Sawada and Dr. Tadashi Shimada having taken care of us. Also I would like to express my gratitude to Mr. Kazuki Imasato of Snyder Group, Mr. Tylar Slade of Kanatzidis Group, and Mr. Jiahong Shen of Wolverton Group, who have taken care of me during the visit.

Report for MERIT oversea training

Department of Frontier Sciences, Advanced Materials Sciences SATO Tatsuki

In this oversea training, all of us visit North Western University at Feb. 27th and after that each of us had three free days. I write what I learned, thought and felt in those days below.

○ Tour around North Western University (Feb. 27th)

At Feb. 27th , the first day of the training, all of us visited North Western University and had tour around facilities related to nanotechnology. For me, visit to Institute for Bionanotechnology was most impressive. They developed devices related to health care (ex. circuit detecting sweat or UV rays). It was surprising to me that student who only has background of electronics (not biology) was conducting research and development while studying biology.

○ Visit to Awschalom Group in the University of Chicago (Feb. 28th)

I visited Awschalom Group in the Univ. of Chicago at Feb. 28th . Awschalom Group deal with spintronics and quantum information technology and now they had interest in sensing by NV center of diamonds. Though I was not familiar with that field, visiting was interesting thanks of clear explanation of their research by students. The number of students in the group was large and each of them has their own project and facility.

I heard that research field of Awschalom group changes drastically in the period of 5 ~ 10 years and that is Prof. Awschalom way, not Western cluture. Continuity of research project would not be thought as important. In addition, everyone in the institute was working on their job and interacting each other intensively, and that atmosphere was so exciting.

At Awschalom Group

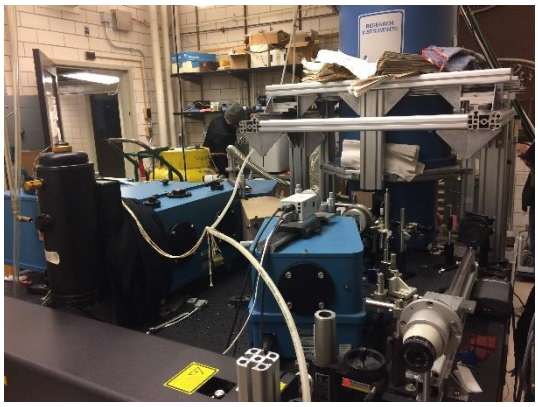
○ Visit to Cooper Group in the Univeristy of Illinois (Mar. 1st)

I visited Cooper Group in the University of Illinois on Mar. 1st.

This group studies strongly correlated electron system mainly by means of Ramman scattering. Target materials are very similar to our group and thus, communication about research was easier than the days before. They had Ramman scattering system under high pressure, high magnetic field and low temperature, probably unique to them in the world, and introduced that machine to us. Usually, so many kinds of excitation in solids can be dealt with Ramman scattering. So, their research field seemed to be interesting. They said high pressure and high filed Ramman setup was built up after a few years of struggle, and their enthusiasm on physics was felt on that story.

In addition, they gave us a tour around Abbamonte Group and Tai-Chang Chiang Group in the same building. Facilities were not overwhelming compared to Univ. of Tokyo. Therefore, the importance of what we do with what kind of motivation was deeply recognized.

Prof. Cooper also drove us around whole campus of Urbana-Champaign. There were few buildings in which university and company collaborate and that kind of collaboration seemed more active than Japan. I am grateful to Prof. Cooper for his driving us in the Champaign city on both Mar. 1st and 2nd , anytime I want.



Part of Ramman setup in the Cooper Group

○Visit to MacDougall Group (Mar. 2nd)

I visited MacDougall group also in the University of Illinois. Target materials of this group was similar to Cooper group and their main tool was neutron scattering. Since neutron scattering is usually conducted in another facility, they showed us stuffs for crystal growth, analysis and measurement. As a day before, those were similar to our ones. In addition, we had a time to introduce our research to Prof. MacDougall and two students. I was relieved because they seemed to understand my research topic in some detail, though it took some time. It would be better if I could relate my topics to their ones in my talk.

○Summary

Universities we visit this time were huge in their scale, but in the level of individual group or laboratory, I felt they were not overwhelming. On the other hand, the research topics of individual person or group was not so fixed, and this point was surprising and interesting to me.

As for languages, it was relatively easy to communicate if I have some background, but I felt difficulty in understand field not familiar and ordinary conversation. Thus, I have to improve my international communication ability.

○Acknowledgement

I am grateful to MERIT for such wonderful oversea training. Prof. Ichikawa, Dr. Sawada and Dr. Shimada set up schedule and guided us. Mr. Takiguchi, a leader in MERIT students, had contact and set meeting with Awschalom group. Prof. Arima, my supervisor, introduced me to Cooper group and MacDougall group in the University of Illinois. Of course I really appreciate all the people who welcomed our visit to United States.

Report of MERIT Oversea Program

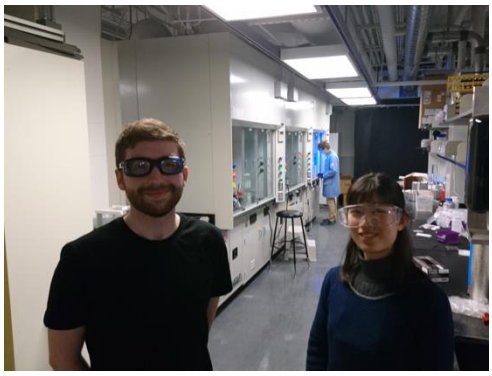
Chizuru SAWABE

Department of Advanced Materials Science

I report my visit to three laboratories while MERIT oversea program.

2018/2/28 Northwestern University, Kalow group

In Kalow group, I discussed my research with Dr. Jacob Ishibashi, post-doc, and Mr. Eliot Woods, master student. They study photopolymerization of π-conjugated polymer, and my lab also studies semiconducting polymer, so we shared our idea about π-conjugated polymers. They also showed me facilities for common use, such as NMR, MS, LC, GC, TGA, DSC, XRD and AFM. These equipments are always in best conditions because each equipment has technician. In Japan, we have to deal with some trouble in our equipments by ourselves. This sometimes interferes our research activities, so I hope that technicians will become more common in Japan.

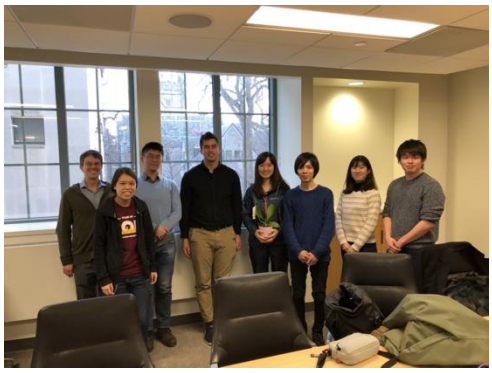


With Eliot

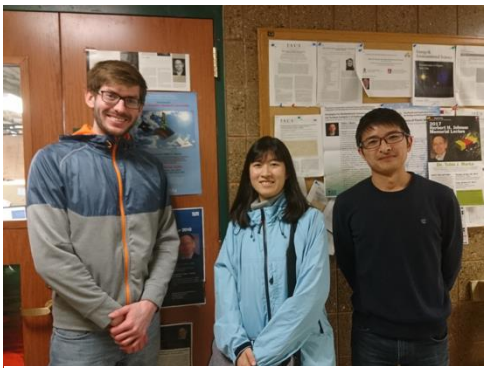
NMRs for common use

2018/3/1 Northwestern University, Stupp group

I visited Stupp group with Mr. Kamegawa, Mr. Suginome, Ms. Noritomi and Mr. Morishita. Dr. Palma coordinated meeting with some post-docs and students in Stupp group. I was afraid that they would have difficulties in understanding my presentation because they are not so familiar to my field, organic semiconductors, and I have few experiences of English presentation. However, Stupp group members asked me many advanced questions after my presentation, so I felt some confidence in my research and presentation.



With Stupp group members



With Facchetti group members

2018/3/2 Northwestern University, Facchetti group

Facchetti group is subgroup of Tobin Marks group, so it has many researchers and rooms for experiments. They studies organic semiconductors in large field from synthesis to device. Dr. Wei Huang and Mr. Brian Eckstein gave me a lab tour, and we discussed our research topics. I could heard really interesting things about TFT from Dr. Wei Huang, and about semiconducting polymer from Mr. Brain Eckstein.

Acknowledgements

I would like to express my appreciation to Dr. Sawada, Dr. Shimada, Mr. Takiguchi and MERIT office. My grateful thanks are also extended to the all people who accepted me during my visit.

MERIT Overseas Training Report

Department of Advanced Materials Science, M1

Shibayama Lab. Takako Noritomi

This oversea training consisted of one day for a campus tour at Northwestern University and three days for individual activities. Here I report what I learned and experienced during this program. Specifically, I focus on the individual activities in this report.

【2/28 Prof. Monica Olvera de la Cruz' Group】

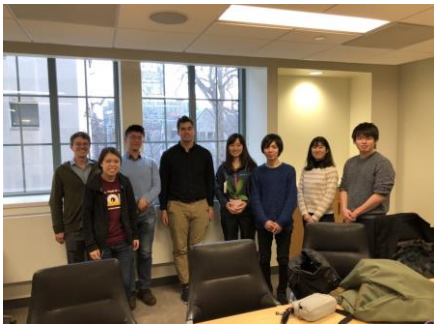
On the first day of individual activities, I visited Prof. Olvera de la Cruz' group in the Cook Hall, at Northwestern University, because her research field is very interesting to me. Some of her research topics include the development of models to describe the self-assembly of heterogeneous molecules including amphiphiles, copolymers, and so on. Frst, I discussed my research, research life, and future perspectives with her. Prof. Monica gave me many important advices for my future. Then, I met the members of her group. With these fruitful interactions, I could get a new perspective of view for my research life.

With Prof. Monica

Cook Hall

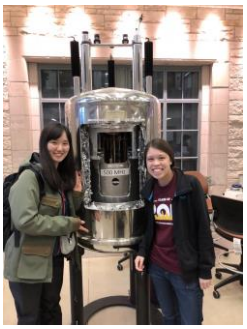
【3/1 Prof. Samuel I. Stupp's Group】

The second day, I went to visit Prof. Stupp's group with my colleagues (Suginome, Morishita, Kamegawa, Sawabe). This laboratory focuses on functions relevant to energy and medicine by development of self-assembling organic materials. Initially, we presented our research to members of the group. Thereafter, members of Prof. Stupp's group took us on a tour of some of their experimental rooms, where I was really surprised to see that their group has seven NMR instruments. The university, as well as the individual professors, have access to funds thus, it is possible to sustain many machines for experiments. I found that this system is very important for researchers in the academic field.



With Prof. Stupp's group

NMR hall



NMR

【3/2 Prof. Stuart Rowan's Group】

For the last day of individual activities, I visited Prof. Rowan's group at the University of Chicago with Prof. Sawada. This laboratory studies the chemistry of non-covalent interactions (supramolecular chemistry). The University of Chicago is located in the South Side of Chicago, which is a somewhat dangerous place. I took the train and the bus to get to the University of Chicago. However, one colleague of mine at Northwestern University said that this route is very dangerous.

Firstly, we met Prof. Rowan and he showed us his laboratory. Then, we presented our research to the members of the group. After the presentation, we had lunch and then a campus tour together with some of the researchers from the same group.

During this time, Prof. Rowan and a master's course student gave me some valuable suggestions about my research. Apart from the discussions, we saw and appreciated the architecture of some wonderful old buildings.

Lunch with Prof. Rowan's group

Lecture building

【Summary】

I had wonderful experiences during this overseas training. Through this event, I realized that “language skills” and “expertise” are very important for global communication. Especially, “language skills” are more important when I explain my research in English and I cannot discuss in detail if I do not have enough communication skills. Therefore, I think I should exert more effort in studying the language.

Finally, I met and talked with many kinds of people during this training, thereby giving me a more global focus on research and life. I would not have experienced this if I did not join this training and I will make certain to utilize these experiences in my research life.

【Acknowledgments】

I am deeply grateful to Prof. Shimada and Prof. Sawada, and the people related to the MERIT program for planning this overseas training. Especially, I would like to thank Prof. Monica, Prof. Stupp, and Prof. Rowan, along with the members of these laboratories for their great hospitality. I gained valuable experiences thanks to them.

The report on MERIT oversea training

Department of Advanced Material Science
Masuda Laboratory, Shunsuke Hasegawa

I would like to thank Prof. Sawada and Prof. Shimada for leading us during training. I am grateful to MERIT office member who reserved our plane and hotel and so on. I would like to thank the many professors and stuffs and students who kindly accepted me to visit.

This year's oversea training was held in the vicinity of Chicago in the USA on a schedule of 2/26 – 3/4. We have three days to active freely, so I would like to report on my activities here.

1st day (2/28) The univ. of Chicago・David Awschalom group

In the first day of the free activity, I visited the University of Chicago where is taken 30 minutes far away from downtown of Chicago by car. Prof. Awschalom had done the great works in spintronics. Recently, his research topics is Nitrogen-vacancy center of the diamond and the defect of the silicon carbide. Since there were laser sources and many optics instrument in every experiment room, I was very surprised at the scale of experiment. The clean room which is constructed recently is most interesting because of the big space and so many instruments. I was surprised that the monitor was attached on the aisle to appeal the people who donated, since some part of the universities of America are managed by the donation.

In front of the Awschalom laboratory

2nd day (3/1) Argonne National Laboratory・Amanda Petford-Long group

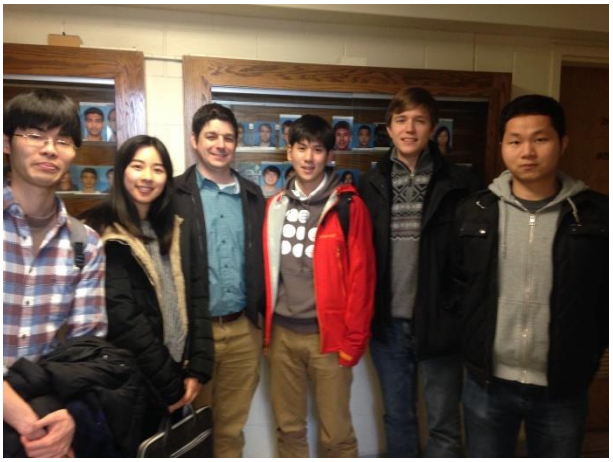
I visited the Argonne National Laboratory which is taken 1 hour from Chicago by train, in the 2nd free activity day. Since ANL has third generation photon source, the security is very hard, and the guard man is checking the people who come into the ANL. Prof. Petfold-Long research uniquely by using the Transmission Electron Microscopy (TEM) and the ion-beam. I was informed of the building where the TEM is installed. There were some tips to reduce the background. First, they remove the vibration even in the corridor. Second, the sounds are gone away in the room. Furthermore, there was

little light and they lighted up the ceiling. I saw TEM for the first time, but I was quite surprised to experiment with the thoughts to reduce the background. Next, I heard their research. They create an artificial quasicrystal by using ion-beam. Then they investigate the alignment of magnetic domains. In addition, it is new method to analysis the experimental data. They are doing all the works from making a sample to analysis by their original method and I was impressed with their research.

With Prof. Petfold-Long

3rd day (3/2)　　The Univ. of Illinoi・Gregory MacDougall group

On the 3rd day of free activity, I visited the University of Illinoi which takes about 3 hours by car from Chicago. Prof. MacDougall is a person who is familiar with neutrons and muons. The research style that they make a single crystal and characterization by themselves, then do the neutron or muon experiment is similar to my laboratory, so it is helpful for me to know their research style. Unfortunately, because the research building was under construction, we could not see so much, but they showed us the pressure cell for magnetization measurement, PPMS, MPMS and so on. In addition, I was able to present my research to him and his students, and they gave me fruitful comments. I thought that I spent a very good time because I was able to talk about practical stuff such as how to analyze neutron data and talk about everyday life with the laboratory students.


With MacDougall group member

Overall Impression

I visited the various places such as university, laboratory, national laboratory in USA, and felt that the laboratory where people gathered from various country was a very exciting and enjoyable environment. On the other hand, in order to be on that environment, I felt that I need not only ability to communicate in English but also the ability to listen without hesitation or to talk about my research more interestingly. There are many things to encourage my future research life and this oversea training has become a very fruitful.

Report of MERIT overseas program
Feb. 26, 2018 ～ Mar.4, 2018

Department of Advanced Materials Science, Graduate School of Frontier Sciences, Shin lab.
First year graduate student, Daiki Matsumaru

2/26: Move (Stayed at Evanston)

2/27: Northwestern University (All members)

There were admirable research facilities in it. So, it seems that the Univ. has abundant funds. The first of tour, we were explained about the overview of the University by slides. We saw many insides and substances of the research facilities such as chemical synthesis rooms, research rooms which you can use freely for several months if you apply and patches to wear skin and analyze components of sweat. The more I knew other research field I noticed that I like my research. In reception with students of Northwestern University because I was sure that we must talk about our research each other, I had a hard time with talking in English. Somehow, I and Robert talk about our research each other while using smart phones. After we talked about future, I was taught the way to learn English. I noticed that it will not tell unless correct pronounce.

2/28: David Awschalom group (University of Chicago, seven people)

I felt abundant fund for research by seeing many equipment. I was heard that while there are many funds from other than country and support for doctoral course are substantial, students were forced to obey the intension of laboratory and there is a severe road to gain the PhD.

3/1: Tai-Chang Chiang group (University of Illinois, two people)

I visited a group which studies very close range of my research: Angle Resolved PhotoEmission Spectroscopy. I was given an opportunity to talk in the seminar which takes about 45 minutes for each person including Q & A. I got nervous not to make a presentation well. Though I got an impression that our laboratory has even nice performance equipment than this group, they seem extends research field by many ideas.

3/2: Advanced Photon Source (Beamline Scientist: Fanny Rodolakis Simoes, one person)

I was also given an opportunity to talk in the seminar at synchrotron facility named Advanced Photon Source. In seminar, I had a question from the researcher looks like native. But I could not understand perfectly, I answered to the part which I understood. Later Fanny guide me synchrotron facility and talk about spectrum experiment at synchrotron facility and our study each other.

3/3,4: move

Summery

I feel I could extend my vision of America and research.

Thanks

Thank MERIT program, Dr. Ichikawa, Dr. Sawada, Dr. Shimada and staff for giving me such the opportunity. And thank Prof. David Awschalom, Prof. Tai-Chang Chiang, Dr. Fanny Rodolakis Simoes, members of each facilities of my visit and the reader of our program, Mr. Takiguchi.

MERIT Overseas Training

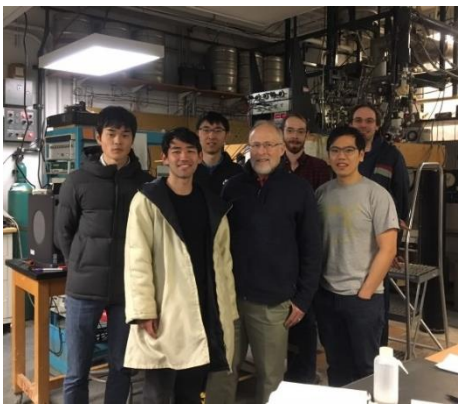
Department of Advanced Materials Science, Graduate School of Frontier Sciences,
M1 Kiyotaka Mukasa

【February 27, Northwestern university】

On the first day of the overseas training, we visited laboratories of Northwestern University. There were many interesting studies such as patches that can analyze information in the body from perspiration simply by sticking them on the skin and ultraviolet measuring instruments that are small enough to be attached to fingernails. Northwestern university was very large and had many buildings which were built by donations from alumni. I felt envious of the amount of the donations from alumni.

【February 28, Halperin laboratory】

On the first day of free time I visited the Halperin laboratory of Northwestern university. First of all, I observed the equipments in the laboratory and got a detailed explanation about what kind of research they are conducting in each equipment. Since the Halperin group creates some of the finest UPt_3 crystals in the world, it was a very valuable experience for me to observe facilities by which they conduct sample synthesis and evaluation. I also participated in a group meeting of Halperin laboratory and had an opportunity to present about my research about 15 minutes. Because I was not used to the presentation in English, I could not answer the question very well. Since I might have opportunities to present my research abroad in the future, I felt it was necessary to practice speaking in English.



【March 1, Professor Leggett】

On this day I had a very valuable experience of seeing Professor Leggett who was awarded the Nobel Prize in physics for theoretical research on superconductivity and superfluidity. It was a great surprise that those who were awarded the Nobel Prize could spend valuable time for me. Although Prof. Leggett is a professor of Illinois university, he came all the way to the University of Chicago in the morning because he had a flight from an airport in Chicago. Thank you for seeing us during the busy time. It was an unforgettable experience to talk with him about my research and receive comments from him.

【March 2, Sauls laboratory】

On the last day, firstly I visited Stern laboratory. The Stern laboratory is a laboratory that is conducting research on low dimensional materials using light. After that, we went to eat lunch with members of Sauls laboratory, and after lunch we participated in group meeting of Sauls laboratory. Some members of Halperin laboratory participated in the group meeting. I felt that such a connection between the theoretical and experimental groups is very good. After the group meeting I talked with Professor Sauls about my research. Professor Sauls taught me about the research that Sauls laboratory and Halperin laboratory are conducting. After that, I talked with the members of the Sauls laboratory about their research life. One of the student I talked with studies very enthusiastically and I was surprised to hear that he spends 12 hours a day in the laboratory.

【Summary】
In this overseas training, I visited two laboratories, Halperin Laboratory and Sauls Laboratory, and met Professor Leggett. Also, although I did not make appointments in advance, I could visit the Stern laboratory and could talk to Professor Chin. Although it was a short period of 3 days, I think I was able to spend a very meaningful time.

【Acknowledgments】
I am deeply grateful to MERIT program, Prof. Sawada and Prof. Shimada, and the professors who accepted my visit.