University Honors Program

Experiential Learning Reflective Essay - Research

**Full Name:** Hai Dong

**UC Email:** donght@mail.uc.edu

**College:** McMicken College of Arts and Sciences

**Major:** Chemistry ACS and Biological Sciences

**Title of Project:** Stem cells research at Children Hospital

**Thematic Area:** Research

**Expected Project Start Date:** May 6th

**Expected Project End Date:** August 23th

Summer research reflective essay

Part 1:

**Provide a brief description of your experience. What did the experience entail? What was most significant about this experience? How did the experience meet and/or differ from the expectations you described in your proposal?**

The summer undergraduate research fellowship program is an opportunity for undergraduate student to do research in the summer at Children’s hospital. Through this program I had the opportunity to work with Dr.Huang at children’s hospital in the mitochondrial genetics field. My project was reprograming stem cells into Retinal Ganglion Cells, a really important type of cell in the eye that without which you will not be able to see anything. Leber’s hereditary optic neuropathy (LHON) is the most well-known mitochondrial disease. People with this disease will eventually lose their vision when they become adult. A lot of people does not known they have this kind of disease until it happens because not everyone can have their mitochondrial DNA sequenced. Our lab is trying to figure out the best way to differentiate iPS cells into Ganglion Cells so that hopefully in the future we can help our patients to gain their vision back again. The most significant thing about this project is that this is the first time I have ever participated in a biomedical research. It gives me hand-on experiences and also help me realize the passion of my life. Having the chance to work with a group of expert in the field provide me a lot of opportunity to learn different things not only just stem cells but also genetics and chemistry. In my proposal I expected to work with a mentor in a one-on-one fashion and I thought that I am going to follow just one project but everything turned out to be completely different. It turns out that the lab need a lot of help because it is new and it is still trying to get everything together so I ended up jumping around and do a little bit of everything. Not only did I participated in the stem cell project, I also participated in some genetics research with TBX3, NARS2, YARS2. This means that I had to do a lot of reading but everything turned out to be so connected that I think If I just work on one project I will never be able to understand the big picture of this lab. I learned a really valuable thing. I learned that doing research is a teamwork and each small section is a individual project that contribute greatly to the mother project. Having understood the system, I now can say that I really love to do research in the future.

**How have you have made progress towards meeting at least 2 of the research learning outcomes you identified in your proposal? Provide specific examples from your experience to illustrate your points.**

I definitely made great progress towards meeting 2 of the research learning outcomes that I mentioned in my proposal:

**I will possess a well-developed awareness of literature in the field**

After a summer working with Dr.Jing and also Dr.wang (for genetics projects) I learned a lot of thing that even Dr.Jing did not know about. Dr.Jing’s main project is to reprogram stem cell into ganglion cells and the cells she reprogrammed was actually come from Dr.Wang. I was able to figure out the connection between the two projects because I worked with both of them. When I was working with Dr.Wang, she ask me to do amplification to over express TBX3. Then I read through a project that Dr.Jing did and I realize that she was trying to compare the reprograming rate of two cell lines, one contain the overexpression of TBX3 and the other one is the control. From that I was able to figure out that we were trying to study the effect of TBX3 on the proliferation and the differentiation rate of stem cells. This example is a typical example about what I learned during my research at Dr.Huang’s lab.

In my proposal I was not very specific about the type of disease that I was going to study in the program but after doing research for 3 months, I know the purpose of our research. Leber’s hereditary optic neuropathy is a really common mitochondrial disease and like others mito lab, our lab also study about this disease. The study of retinal ganglion cells that our lab is doing related very closely to this diseases. Since the patients with this disease lose their vision because of their ganglion cells was abnormal therefore a replacement in retinal ganglion cells is really essential because there is no way to recover these cells. Although using stem cell to replace cells in human eyes is impossible right now because we do not know what might happen after do replace those cells with our cells. Clinical trial on human is forbidden because those reprogramed cells can turn into tumor cells. This is why we have to do a lot of research about this method before we can actually try it on human. I talked to Dr.Huang during the time I work in the lab about clinical trial and he said that it is true that we cannot test it on human but he hope one day his research can be used as a key study to cure the LHON disease.

I came in to talk to Dr.Huang a lot during the summer. We discussed a lot of thing related to the research because I am new to the field. He instructed me really carefully and he always encourage me to think outside of the box. I also learned a lot about his career and the career of a pediatric physician in general. These information is really valuable because it help me to decide which career I should follow in the future.

**I will have the ability to think beyond the just completed research and articulate how my world of view has been impacted by the experience.**

This lab provided me a lot of opportunity to think beyond what I learned in lab. Techniques are important but they are just tools, the thing that I actually learned in this lab is scientific reasoning and thinking. From one project I was introduced to others and then I had chances to learned different things all in one place. I understand that we work on Retinal Ganglion Cells but I never know the reason behind the disease causes the lost of this type of cell. After doing genetics research on mitochondrial DNA I learned that some point mutation in the mitochondrial DNA causes this disease and that is why we need to do research on stem cell to find a possible treatment for this type of disease in the future. So the work that we did with stem cells is to find new possibility, the actual research on the disease is actually on DNA analysis. We try to study the connection between the point mutation with ganglion cells. We try to learn how they interact and what else can these point mutation cause. We do not just stop there because lab work have to be realistic also. So I learned that we also doing clinical research on this aspect. I found that people actually published a lot of paper about this disease. Most of the paper I found talked about families that carry the mutation that causes LHON. They analyzed family tree and the DNA sequence to contribute to the data pool. Some example of these papers are:

[**Leber hereditary optic neuropathy** in the population of Serbia.](http://www.ncbi.nlm.nih.gov/pubmed/24508359)

Jančić J, Dejanović I, Samardžić J, Radovanović S, Pepić A, Kosanović-Jaković N, Cetković M, Kostić V.

[Frequency and spectrum of mitochondrial ND6 mutations in 1218 Han Chinese subjects with **Leber hereditary optic neuropathy**.](http://www.ncbi.nlm.nih.gov/pubmed/24398099)

Liang M, Jiang P, Li F, Zhang J, Ji Y, He Y, Xu M, Zhu J, Meng X, Zhao F, Tong Y, Liu X, Sun Y, Zhou X, Mo JQ, Qu J, Guan MX.

[Point mutations associated with **Leber hereditary optic neuropathy** in a Latvian population.](http://www.ncbi.nlm.nih.gov/pubmed/24319328)

Aitullina A, Baumane K, Zalite S, Ranka R, Zole E, Pole I, Sepetiene S, Laganovska G, Baumanis V, Pliss L.

So there are many way for me to actually develop my research based on these 3 aspects. If I want to do clinical research I can go with Dr.Huang to see patient and help him conduct datas. If I want to learn about treatment I can study stem cells with Dr.Jing. If I want to do research on genetics I can follow Dr.Wang. This is such a great opportunity for me to actually be in a working environment hat I have always dreamed of. The more I understand about the system of this lab, the more I want to be a research physician in the future.

**Part 2: So What?**

* How did your experience impact your development (academic, professional, and/or personal goals)?
* **What academic theories, readings, courses, or concepts did you rely upon to inform to your experiential learning work? How did knowledge of this theory, reading, course, or concept contribute to your learning in this project?**

This experience impacted me strongly in a lot of way. This is a great chance for me to develop my academic knowledge and indeed I learned a lot about genetics, stem cells and some clinical research. I also learn how to work professionally during the time I was in the lab also. Coming to lab everyday on time and get to work right away after classes seem to be a bit of a rush schedule but It help me later on to get a really good reference letter from my PI. I am also really close to everyone in the lab so the learning process is really easy now. Every time someone have work to do they will let me know so that I can follow them to learn new things. Sometime if the work is not too important I can even do it by myself and eventually they will let me help them all the way if they think that my skills are good enough. At the end of the experience I got the chance to share my experience with other people at the poster session and it was a great thing to do because I have the chance to wrap up what I did for the whole summer and talk about it to others. Working in this well structured lab once again confirmed my goal of being a research physician. I think that his career pathway is definitely the one for me because I can do both research and do some clinical work too. After joining this lab, there is a lot of opportunity came to me. I am applying for my summer research and currently waiting for the result to come in March. I also continued to work in Dr.Huang’s lab and this is my third semester already. I am also studying for my MCAT in order to be able to apply for M.D./ Ph.D. program. Although there is a lot of difficulty on my road to success because there are only few international students got into medical school nationally but I think I have a good chance to be one of them. This is the career that I really want to have and I will work hard for it.

This research experience connected really well with my first semester of Biology. In this course we studied a little bit about genetics and Cells biology also so it is a really great way to use my knowledge for something outside of the class. In the genetics research that I did during this time we studied about TBX3. At first I do not exactly know how to study functions of a gene so I have to read some paper in order to get some basic knowledge:

[Mouse **TBX3** mutants suggest novel molecular mechanisms for Ulnar-mammary syndrome.](http://www.ncbi.nlm.nih.gov/pubmed/23844108)

Frank DU, Emechebe U, Thomas KR, Moon AM.

[The T-box transcription factors TBX2 and **TBX3** in mammary gland development and breast cancer.](http://www.ncbi.nlm.nih.gov/pubmed/23624936)

Douglas NC, Papaioannou VE.

I saw that to study a gene function usually they will have to amplify this gene to see its function more clearly. Therefore PCR is a really helpful technique to use in this situation. We amplified the gene then we transfect it into the cells to culture. After we culture the cells, we did some data analysis experiment too quantify the concentration of the protein and the expression of some specific markers to see if TBX3 actually made a significant change in function or not. A lot of these information will be hard to understand if you do not have a basic foundation about cells biology and genetics.

**Part 3: Now What?**

* **How are you integrating what you learned from this experience into your life? What connections have you drawn between this experience and other experiences both within the classroom and beyond?**
* **How have you shared your learning with others and disseminated your work? Who was your audience and what did they learn? What did you gain from the experience of sharing your learning with others?**

I am right now still working with Dr.Huang and these skills are really valuable to me because right now I am able to handle work by myself without observation from my mentor. I know that I have contributed greatly to 3-4 projects and I hope all of them will be successful. Of course doing research is never simple, sometime I spend the whole week doing experience and in the end the result was not what we want to see but we just have to keep repeating it until we are sure about what we have. This experience is unique compare to others experience that I have had before. This is the first time I have ever been able to work in a well structure group to work toward a big project. It is also my first medical science research because before that all I do was chemistry. It is really exciting to see the impact that we can make on the world by just spending time doing what we love in the lab. I really appreciate the way labs works because every time we publish something, everyone around the world will get the benefit from it. This is something that I want to do with my life. Contribute my small life to this great thing that is being done by other scientists.

I have done a poster presentation at University of Cincinnati medical campus and it was a really great experience to me. It was my first time to present a poster so I had collected some feedback to make my next poster better. I also had the chance to see other people poster too and it was a great thing to learn from other students on that day. There are a lot talented student with so many meaningful project. I am glad that I can be a part of them to join hand and make the world a better place. I hope in the future there will be more experience like this for me to learn and develop.