

# **SUPPORTING PERSONALIZED LEARNING**

**Grand Challenges Scholars Portfolio**

**Grand Challenge: advance personalized learning**

**Submitted in partial fulfillment of the Olin College  
Grand Challenge Scholars Program requirements**

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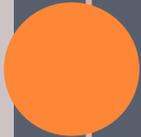
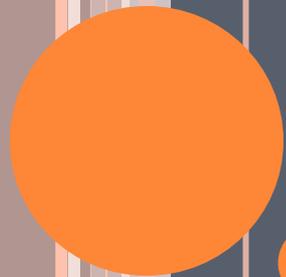
# INTRODUCTION/OVERALL REFLECTION

This is my portfolio for the Grand Challenge Scholars Program. In this portfolio, I reflect on my experiences at Olin College within the following five areas:

1. Entrepreneurial Experience
2. Global Awareness
3. Interdisciplinary Experience
4. Service Learning
5. Long Term Project addressing a Grand Challenge

These experiences have helped me develop the skills necessary to tackle the Grand Challenges of the 21<sup>st</sup> century. In particular, the Grand Challenge that I am committed to addressing is advancing personalized learning. Teaching and education are the focus of this portfolio, as they have been the focus of my work at Olin. Many of my efforts in this area have centered around Engineering Discovery, a student-run engineering outreach organization, but several other activities I have participated in tie into this Grand Challenge as well. In my entrepreneurial experience I gained important teamwork skills and Olin's heavily interdisciplinary curriculum has prepared me to tackle problems from multiple perspectives. These skills are bound to be helpful in pursuing any Grand Challenge as Grand Challenge problems do not lie neatly within the bounds of a single discipline, nor are they possible to tackle individually. In addition, my travels abroad have given me a valuable perspective on other educational systems and an appreciation for the work that is already being done to advance personalized learning. In total, I believe my time at Olin has equipped me with the skills I need to tackle the Grand Challenge of advancing personalized learning. I am excited to continue my work beyond Olin and bring the lessons I have learned as a Grand Challenge Scholar with me. The reflections that follow represent just a small part of the work that I have done which prepares me as a Grand Challenge Scholar.





# ENTREPRENEURIAL EXPERIENCE

Midnight Bakery

# MIDNIGHT BAKERY

In the summer after our first year at Olin, two of my friends started a bakery on campus. Originally they had planned to close the bakery at the end of the summer, but when we got back to school in the fall six of us decided to continue running it together. To keep the time commitment manageable, we decided to bake just once a week on Friday afternoons (with occasional special events on other days) and sell our baked goods on campus as well as at a local farmer's market. Throughout the year, we learned many lessons about baking and teamwork. Initially, my baking style was very different from what my friends had been doing over the summer. However, as a newcomer, I knew that I should be open to change and so I adopted their baking methods and found that they had many benefits. In addition to reconciling our baking styles, we also needed to work to standardize certain aspects of our baking to ensure that our products came out well consistently no matter who was in charge of making them. After a few weeks involving some ridiculously large cookies and a few over-baked recipes we eventually made our production consistent.

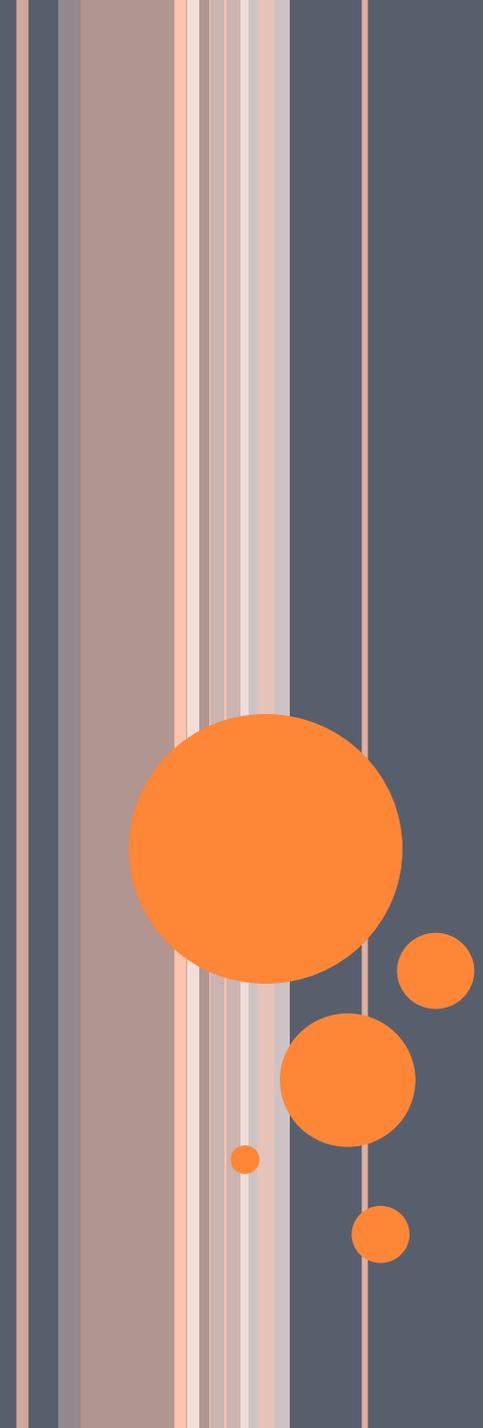


# MIDNIGHT BAKERY

As we became more familiar baking together, we discovered that we each had certain recipes that we preferred to make. This added another layer of complexity to our baking process, as we tried to honor people's individual preferences while also ensuring that we finished baking everything we needed each week. Although this was a more difficult optimization process, it was worth the effort because the end result was that we all had more fun. None of us were in the bakery because we had a strong desire to be entrepreneurs – we were there because we enjoyed baking and we saw an opportunity to do something cool with it. Each of us was able to individualize our experience in the bakery so that we learned and did the things we

were most interested in. We learned how to simultaneously work together on a team and specialize on certain tasks. This process continues to be valuable to me in both academic and extracurricular projects. For example, when working on interdisciplinary teams I frequently divide tasks so that each person is working primarily in his/her area of strength, but we also work together to ensure that the entire project will integrate well. From an extracurricular perspective, effective teamwork was invaluable during my time running SERV, the umbrella community service organization at Olin. SERV consists of eight people who work together to find, organize and run community service events for anybody in the school to participate in. Within the group of eight, we each took on specific roles such as managing finances or communications in addition to working together when preparing for specific events. By dividing tasks we made sure there was a clear point person for any work that needed to be completed but at the same time we collaborated on larger efforts to ensure that the workload for any one person remained manageable. These experiences working on teams are good preparation for tackling any of the Grand Challenges which will undoubtedly involve significant teamwork.





# GLOBAL EXPERIENCE

Budapest, Hungary and Leuven, Belgium

# GLOBAL EXPERIENCE

In the summer after my first year at Olin, I spent 4 weeks studying at Aquincum Institute of Technology (AIT) in Budapest. AIT was a brand-new school, designed to be a place for American students to study abroad. For that summer they had invited 28 American students to come take classes and give them feedback as a sort of trial run before they opened for their first official semester of classes the following spring. In addition, there were 7 Hungarian students taking classes with us. From my interactions with the Hungarian students and professors, I learned a lot about the history and culture of Hungary. I visited historical sites throughout Budapest and heard stories of what had happened in each place and how it continued to affect Hungarians' lives and attitudes to this day. The people I met in Hungary appeared to be much more connected to their country's past than the Americans I interact with. The following summer I was abroad again – this time in Leuven, Belgium – and I again experienced the same phenomenon.

In both Budapest and Leuven I also learned from European students about their educational systems, which are very different from what I have experienced in America. In Budapest I learned that higher education in Hungary is so heavily subsidized by the government that it is close to free for all students. I also learned that Hungarian students have virtually no choices at all about the classes they take and that their classes have relatively high failure rates. I found that to be a confusing juxtaposition: on one hand, subsidies that seem to indicate a strong commitment to the education of all students, and on the other hand, a rigid educational structure noticeably lacking any personalization and allowing many students to fall through the cracks. I returned to Olin much more appreciative of the ability I had to control my own education and the plethora of supports designed to stop me, or anyone else, from falling through the cracks.



AIT-BUDAPEST



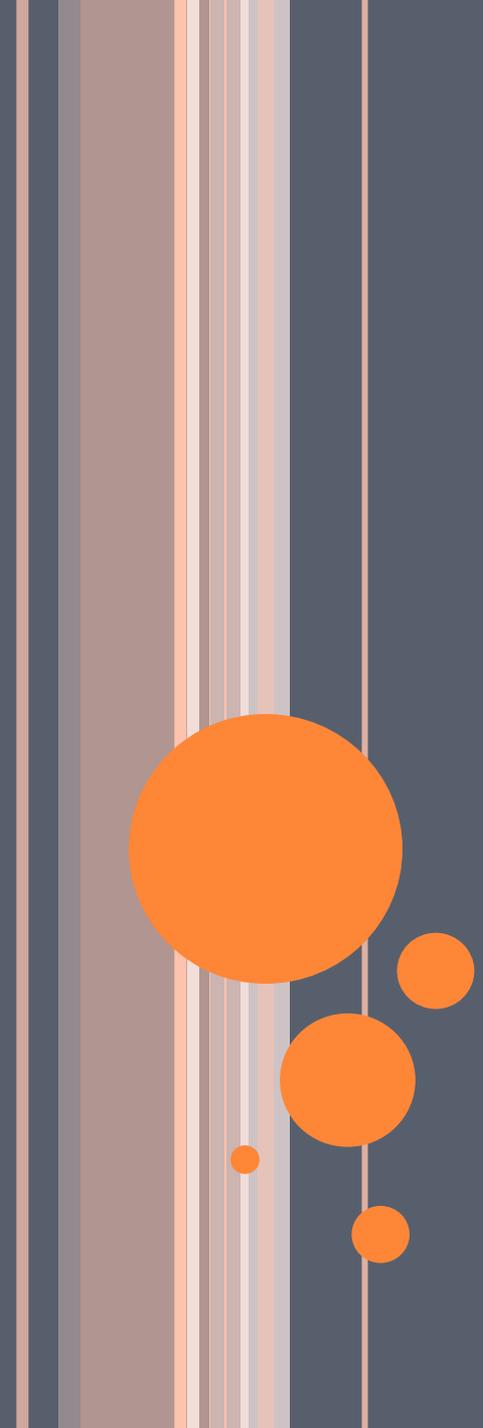
AQUINCUM INSTITUTE OF TECHNOLOGY



# GLOBAL EXPERIENCE

In Belgium the following summer I saw many aspects of their educational system that were similar to Hungary's. Students had very little autonomy and classes had high failure rates. In Belgium, grades were heavily dependent on final exams, so students learned very little throughout the semester and then worked very hard at the end of the semester to learn everything in time for the exam. However, I also talked to people in Belgium who were working hard to change this educational model. They were trying to incorporate more practical projects and interdisciplinary work into the curriculum. While I left Belgium again grateful for the education I was getting at Olin, I also gained an appreciation for the fact that there are many people throughout the world working to improve education. As I continue to work to advance personalized learning, I will need to work with students and teachers from other countries, cultures and backgrounds. In addition, it is highly likely that at some point in my career I will collaborate directly with educators in other countries. My experiences in Hungary and Belgium have helped me understand other cultures and educational backgrounds and have prepared me well to interact with students and teachers from around the world.





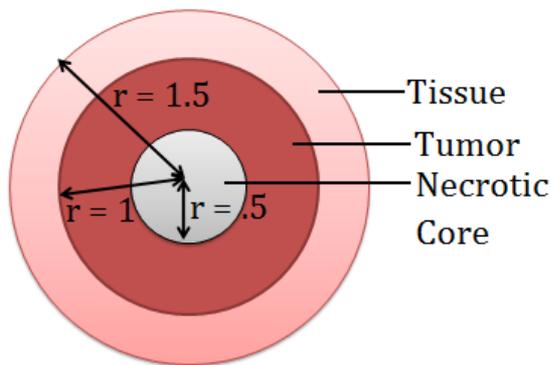
# INTERDISCIPLINARY LEARNING

Transport in Biological Systems, Partial  
Differential Equations and Electricity and  
Magnetism

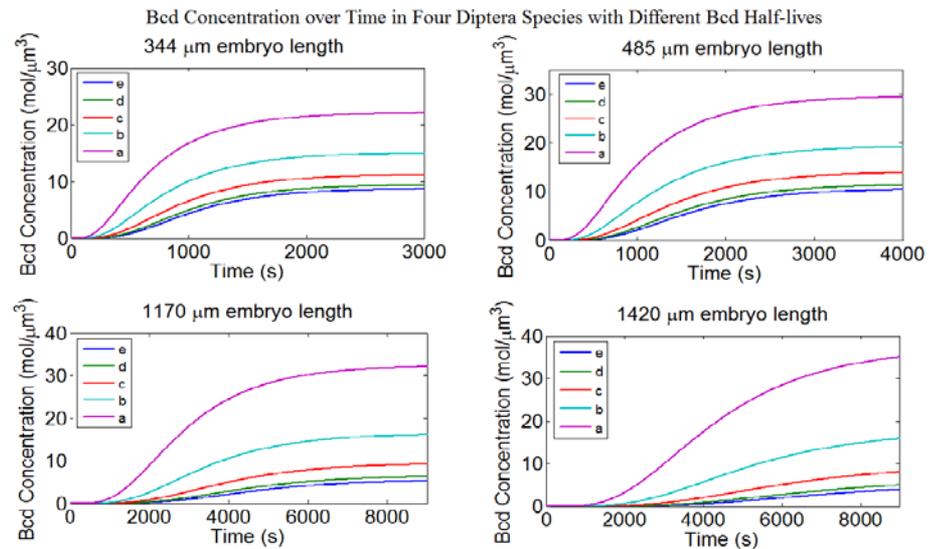
# INTERDISCIPLINARY LEARNING

Olin's curriculum is inherently interdisciplinary. From my first semester classes such as Modeling and Simulation of the Physical World (which connects math, physics and programming concepts) all the way through my senior capstone project, I have been constantly working on projects that require application of knowledge from multiple disciplines. While there are many examples I could discuss, this reflection focuses on just one.

In the spring of my sophomore year I took a course called Transport in Biological Systems (BioTransport). In this class, we learned about physical phenomena such as diffusion and fluid flow in the context of biological problems such as tumor growth and wound healing. We then created mathematical models of the systems we were studying, implemented our models in MATLAB, and wrote papers presenting our results. In this one class I was therefore connecting the disciplines of physics, biology, mathematics, programming and writing. By studying one system through all of these lenses I was able to get a much greater depth of understanding than any one discipline alone could possibly have provided.



A figure from one of our papers



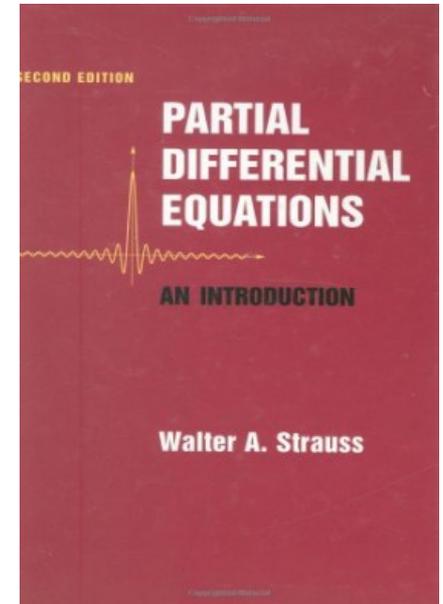
Results from one of the models we created in BioTransport

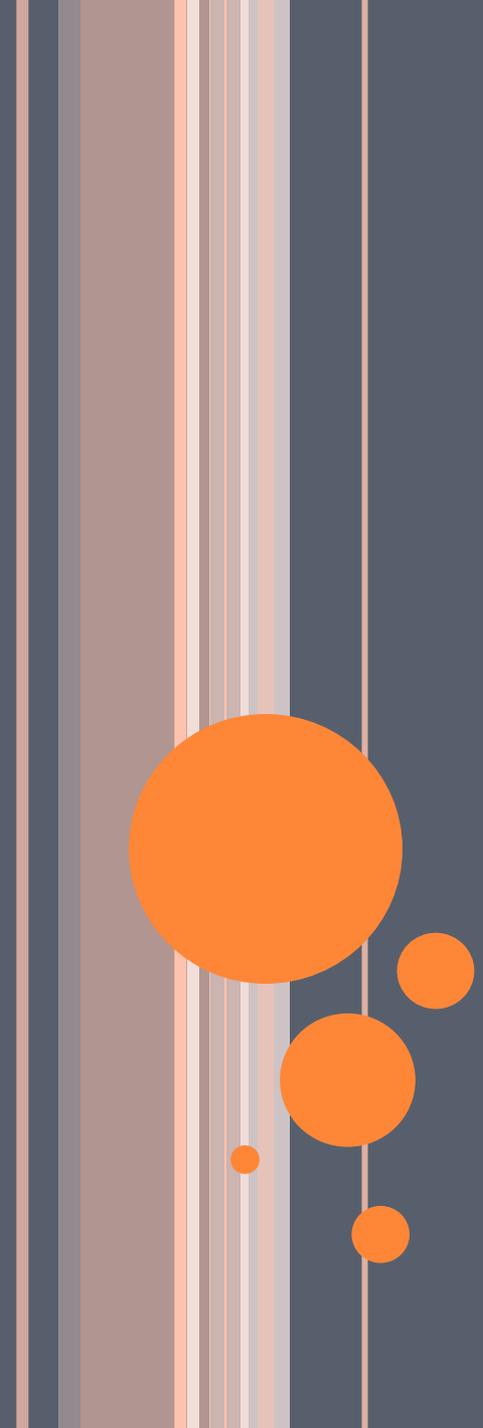


# INTERDISCIPLINARY LEARNING

During the same semester I was also taking a separate class in partial differential equations (PDEs). All of the mathematical models we created in BioTransport involved partial differential equations and so I was able to immediately see applications of PDEs as I was learning about them. In BioTransport, we focused primarily on solving PDEs numerically, while the pure PDEs class was more focused on analytical solutions. By learning both approaches simultaneously, I was able to reach a deeper understanding of the subject and an appreciation for the strengths and limitations of each approach. On top of all that, I was a course assistant during the same semester for an Electricity and Magnetism class in which students were briefly introduced to PDEs and used MATLAB to solve them numerically. Thus, I was able to reinforce what I was learning in my own classes by teaching it to younger students in yet another different context. In this way, I experienced three very different disciplinary perspectives on PDEs as well as combining that math with several other subjects to gain greater understanding of biological systems.

At Olin, I have learned that almost all meaningful problems require knowledge from multiple disciplines in order to be understood and solved. This is certainly true of all of the Grand Challenges. As a future teacher working to create personalized learning for all my students, I expect that my students will encounter challenges that can only be solved with an interdisciplinary approach. I believe that my interdisciplinary experiences at Olin have prepared me well to guide my students through finding and solving such problems.





# SERVICE LEARNING/LONG-TERM PROJECT

*Engineering Discovery*

# ENGINEERING DISCOVERY

Engineering Discovery is a student-run engineering outreach organization at Olin. Its mission is to foster passion and excitement for engineering and science in K-12 students of all backgrounds. Through open-ended, hands-on team projects we work to help our students discover the value and joy of technical problem-solving. Engineering Discovery works with students in a wide variety of situations. We teach weekly recurring programs both in schools and in after-school programs. We also host many different one-time events both on campus and at nearby museums, schools and libraries.

I became involved in Engineering Discovery during my first semester at Olin and have continued to be heavily involved every semester since then. I started out as a general member of the organization and gradually assumed greater responsibility, first leading individual activities and eventually becoming co-head of the organization. Before being at Olin, I had little to no experience with teaching, curriculum design, or leadership, but my work with Engineering Discovery has taught me a lot about all of these things.



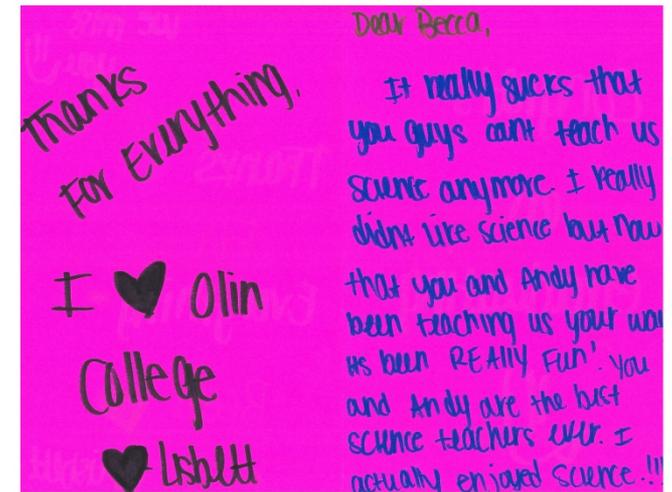
# ENGINEERING DISCOVERY

During my first few semesters in Engineering Discovery I didn't really know what I was doing. I mostly followed the lead of the older Olin students and shied away from taking charge of any lessons we taught. Then in the spring of my first year someone outside suggested that we should teach at Cook's Afterschool Program, a program that serves elementary school students in an area of low-income housing in Needham. I had been tutoring students in that program since September, so when working at Cook's became a regular Engineering Discovery activity it was natural that I was in charge of it. As far as leadership activities go, this was a relatively low-pressure, low-time commitment way to start. We taught at Cook's for one hour every other week during that semester, which actually amounted to only three lessons in the spring since the semester was already half over when the activity started. Nonetheless, it was a significant experience for me because that was when I began to be comfortable with the idea of leadership and when I began to see the importance of designing curriculum for individualized learning.



# ENGINEERING DISCOVERY

The children at Cook's Afterschool Program ranged in age from 5 to 12, which made the necessity of personalized learning particularly obvious. However, in reality, all of Engineering Discovery's activities are designed to support personalized learning. The general structure of our activities is to give students some sort of design challenge and have them solve it. After a brief introductory discussion, students work (usually on teams) while we hop between groups providing whatever additional guidance or feedback each group needs. The autonomy that students have in this environment allows them to personalize their own experience and makes it easy for us to adjust to the individual needs of students. As a first year, I didn't fully realize how our activity structure actually supported our educational goals – I just knew that hands-on activities were fun for us and for our students. However, as I continued working with students at Cook's Afterschool Program throughout my sophomore year as well as getting involved in other activities (doing advanced math with 3<sup>rd</sup> graders in Needham and teaching science to 6<sup>th</sup> graders in Hyde Park) I became more aware of the ways in which our teaching could affect students. I learned to encourage students to explore instead of looking for a single right answer, to ask questions that would elicit student thinking and to use backwards design to create lessons aligned with the topics students were learning in their normal classes. By the end of my sophomore year I had learned a ton about teaching and realized that there was a ton left to learn. I had discovered the enormous value of co-teaching in order to learn from my peers, and I had also found out just how much there was to learn from my students. Through all of this, I had become far more comfortable leading a classroom. Now it was time for me to step up and lead the organization.



# ENGINEERING DISCOVERY

In the fall of my junior year, I became co-head of Engineering Discovery along with three other members of my class. At that point, Engineering Discovery was at least twice the size and several times busier than it had been when we joined as first-years. That year, we had six different activities running weekly at various schools as well as about ten activities that were one-time events. In the spring of 2012, this amounted to at least 300 person-hours spent working with children, not to mention the planning time before that. Overseeing all of those activities was overwhelming at times, but it taught me a lot about leadership. I learned how important it is to stay organized and to have systems for making sure nothing gets forgotten about. I also learned that while it is important to know what is going on throughout the organization, it is not necessary to know every detail. I learned to delegate tasks to leaders of individual activities and to trust those leaders to do well. I developed the habit of checking in with people to find out whether they needed more support, but if they said they were fine, I learned to stop worrying about whether every detail was perfectly planned. Meanwhile, I also continued teaching and working to improve my teaching. As much work as it was to lead Engineering Discovery, I wasn't going to let that take me away from what I really love doing: working with children and helping them discover a personal excitement for math, science and engineering.



# ENGINEERING DISCOVERY

Finally, during my senior year I continued to both lead and teach in Engineering Discovery, as well as working to ensure that the organization would stay alive and strong after I graduated. Of the four members of the class of 2013 who had been leading Engineering Discovery only two of us came back during our senior year, but we recruited two sophomores to join us in leadership. This provided an ideal way to transition leadership. The sophomores started the year with minimal responsibilities and gradually took on more tasks as they arose until we were eventually all equal leaders. As the year approaches its end, I am now confident that the sophomores know everything they need to continue being successful and they even have two new leaders lined up to join them next year. As a first-year, I barely knew enough to think beyond the next lesson I was about to teach, but over the course of four years I developed the ability to focus on the bigger picture and work to ensure the long-term success of Engineering Discovery as an organization.

Throughout my four years at Olin, my involvement in Engineering Discovery has been my largest, most consistent focus. Much of my growth – as a student, a teacher, and a leader – has been spurred by my experiences in Engineering Discovery. I have developed the ability to design effective curriculum, recognition of the value of collaboration in teaching and a set of leadership skills, all of which will serve me well as I continue to pursue my commitment to advancing personalized learning.

