Testimonial from Frederick Qiu

Dear Future Readers,

This is Frederick Qiu, a senior of Central Bucks High School East (Doylestown, PA). Although I was an outstanding student academically and participated in a variety of extracurricular and leadership activities, I am certain that the research I conducted as a result of this book was one of the key pieces of my application which got me accepted to Princeton University. Here I would like to share with you my experience in reading this book and trying the programs provided in it.

The age-old complaint one might hear from a disgruntled math student comes in many forms: “How is this ever going to be helpful? Why do we have to learn this? When am I ever going to use this?”

The student that asks these questions is right, in a sense; what matters in a math class is not what you’re doing directly, but how you apply what you learn. In that regard, one of the purest ways to apply mathematics is through research. When you think of research, you might think of adults in lab coats, operating expensive equipment. In reality, research can be as simple as working on your computer at home, manipulating data sets to draw conclusions and create models. This book contains the tools you need to conduct your own statistical analyses with powerful coding languages like R and MATLAB.

After following the videos provided in the book, I was able to conduct my own research regarding pollution and popular perception of it, which was published in a science journal (MDPI) and accepted for presentation at an annual conference (AIChE), all while I was only in high school. I cannot recommend this book enough, as getting a head start into the material will deepen your interest in mathematics and give you a skillset that allows you to be able to conduct your own research and glimpse into what a future career in the field might look like. And, as a note from one student to another, having hands on experience like research never hurts in something like a college application, where you need to truly distinguish yourself from the heavy competition.

Sincerely,

Frederick Qiu

A senior from Central Bucks HS East

July 3th, 2019
To Whom It May Concern,

My name is Peibo Guo and I am a senior at Conestoga High School. I plan to major in Environmental Sciences/Materials Science Engineering/Biochemistry in college and I participated in this project this past summer, to learn more about the field. Through it I learned that microbial fuel cells produced clean bioenergy through a reduction-oxidation process using microbes, and that they also cleaned water systems through a desalination process. I also found that MFCs collected and formed masses of precious materials from the whole reaction as a byproduct. In addition to their processes, I also learned how to construct microbial fuel cells so that I could construct one and study its functions even further.

This project really helped me because as a student who was under 18 at the time, it was extremely hard to find internship/experience due to a revision of the Pennsylvania Law on minors in July of 2016. Therefore, this project gives opportunities to students who are passionate about environmental sciences and want to gain experience but are under 18 (especially Pennsylvanian students). Personally, I really enjoyed this project because I gained experience outside of the classroom and it related to the major that I was pursuing in college. Moreover, the project gave me a direction of the kind of research I wanted to focus on in college: biomass materials. During this project, I learned that the material costs of microbial fuel cells outweighed their energy benefits. To overcome this financial barrier, I will plan to study under a materials science engineer/environmental sciences major to research and further develop biomaterials.

The skills I gained were the usage of MATLAB, which is a popular program used by engineering departments. This project also allowed me to improve my time management skills since I had to develop a strict schedule to meet the deadlines for this project in addition to maintaining my involvement with schoolwork, sports, and extracurricular activities.

In my college supplements, I mentioned the project in every single essay for each college to show that I am indeed interested in the major that I am pursuing, and it allowed me to shine above other applicants, who lack the same experience.
Overall I enjoyed the project because it is not difficult to complete, and the project itself is not time-consuming. I also liked how it educated me on microbial fuel cells well and that it gave me a real experience of what researching renewable resources was like. I learned copious amounts of information on the structure, function, and processes within microbial fuel cells which validated my major and helped me in the college process.

Peibo Guo
Testimonial from Clement Ekaputra

To future readers,

My name is Clement Ekaputra. I am 21 years old, going into my final year at the University of Pittsburgh with a major in materials science and engineering, and minors in mathematics and French.

When I was in my junior year at Great Valley High School in Malvern, Pennsylvania, I had the opportunity to do my first research project with Dr. Zuyi Huang at Villanova University. Under his guidance, I learned about microbial fuel cells, devices which harness the natural metabolisms of bacteria to simultaneously purify wastewater and generate electricity. We modelled the effect of nutrient flow rates on the bacterial populations and power generation of the fuel cell using MATLAB Simulink, a graphical modelling tool. I was fortunate to be able to present this work at the 2015 Mid-Atlantic ASEE Conference, and had a paper published in the conference proceedings.

Because of this opportunity, I have gained many benefits that have helped me throughout my academic career. For a start, having research opportunities like this is uncommon among high school students. This helped me to focus my college essays, which certainly helped me to get into the University of Pittsburgh with an academic scholarship. And having work experience, a presentation, and publication doesn’t hurt either!

The skills I learned in research have also helped me to succeed in classes. Because research involves working in an open space where not all the information is readily available, I gained a lot of practice in learning independently and seeking out knowledge to solve problems. When in a classroom setting, the material as a result comes much more naturally, connections between different ideas become more apparent, and doing problems for homework or for exams became easier.

Moreover, it helped me to focus my efforts while in college. Because of this project, I learned that I really enjoyed doing research. I was learning something new every day, whether it was about how microbial fuel cells work, or how to model systems using differential equations, or about controller design – none of which I had ever learned before, but were made accessible with close mentorship from Dr. Huang and tools like MATLAB Simulink. I enjoyed problem solving, thinking critically about real-world needs and overcoming challenges to fulfill them.

Because I worked on this project, I knew I wanted to do more research in school, and I pursued many other opportunities – computational and experimental, in academia and industry, domestically and abroad. Currently, I am a materials research intern at Mine Safety Appliances, a company which develops safety products for workers in hazardous conditions all over the world. I also was selected for a summer research program at MIT, where I am working to develop novel methods of 3D printing. What gave me the technical knowledge, analytical skills, and confidence to pursue these opportunities was simply having research experience, which began with the microbial fuel cell project during that junior year summer of high school.

Now, as I apply to graduate school, hoping to one day develop materials for aerospace applications, I think about what enabled me to pursue this career path. What helped me get more and more opportunities to do research, learn a variety of skills with wide benefits, and have confidence in the face
of huge problems, was the help I got from all those I have worked with, and especially Dr. Huang. I am very thankful for his mentorship and for the opportunity to conduct research on microbial fuel cells with him. This book written by Dr. Huang includes all the detail of the microbial fuel cell project. I believe it will offer many other students similar opportunities to build a good foundation for their academic career.

Sincerely,

Clement Ekaputra

July 30, 2019