

BioGENEius Awards: In Emily Wang's Words

Even when she was in the lab “almost going blind” from manually selecting bright protein mutants by eye, Emily Wang insists she was appreciative of every moment. This tenacity has helped produce quite a resume: Harvard University graduate; developer of mRuby3 (the brightest red fluorescent protein to date); software engineer at Facebook. In the essay that follows, Wang reflects on her fond memories of BioGENEius Challenges, including her 2014 win. She credits her involvement in the program with not only inspiring her academic pursuits but also with introducing her to fellow scientists she now considers lifelong friends.

One of my favorite quotes of all times is: “If you do nothing, nothing happens.” In high school, for three years, I participated in the BioGENEius Challenge, and each year, I’ve learned something new that has changed my way of thinking, whether it was a new cutting-edge technique to explore, or a new strategy to better communicate ideas. The BioGENEius Challenge empowered me to continuously learn and adapt my approach, rather than “doing nothing,” and challenged me to grow as a researcher and individual.

In 2012, I was curious about a resinous substance produced by bees called propolis and wanted to investigate its purported anti-cancer properties. Foraying into biomedical research for the first time, I emailed many labs and finally found a lab almost one-hour away from my home that was willing to teach me safety protocols, how to design experiments, and how to culture mouse colon cells and carry out assays. After half a year of practicing techniques, reading the literature, refining my project design, and executing the experiments, I found some interesting results supporting propolis’ anticancer effects and presented at Bay Area BioGENEius challenges.

Having the opportunity to traverse through the research process, from idea formulation to experimental design, at such a young age, was an influential experience that I am immensely grateful for. At Bay Area BioGENEius, I was also asked interesting questions by the judges and was amazed by the high-caliber of research from my peers, who utilized cutting-edge techniques with mentorship from university labs. I was motivated from my first experience at BioGENEius to set higher expectations for myself as a scientist. I embraced the suggestions I received from the judges, and I aimed to design a more professional poster that better illustrated important results, to handle Q&A with greater clarity, and to identify mentors at universities.

I continued to read more biomedical research papers (where almost every other word was highlighted for me to search up) and emailed professors for advice and research opportunities, citing the papers

produced from their lab that I was intrigued by. I received mostly rejections but was fortunate to receive one promising email from a Stanford bioengineering professor. After finding out I was in high school and had not taken AP Biology or AP Chemistry, he said that it wasn't feasible for me to join the lab, but I insisted, pledged to self-study all the materials, and pleaded for the opportunity to research in his lab. I am happy to say it worked out.

The BioGENEius Challenge taught me the intensity and vigor necessary for one to build something impactful. It has demonstrated to me the tangible results that may occur if you invest time and energy into a problem that you care about. At Stanford, I worked on developing bright and photostable fluorescent proteins to detect biological changes at the molecular level. Whether I was almost going blind from manually selecting bright protein mutants by eye, or desperately trying to capture each pink droplet of purified protein using magnetic beads or hunching over in the dark microscopy room bleaching proteins with a laser to measure photostability, I was appreciative of every moment. Each day after class, I would cheerfully rush to lab, and I was excited come in on weekends and holidays. I presented my new work at BioGENEius again and was fortunate to attend the International BioGENEius Challenge for the following two years.

At the BioGENEius Challenge, I was inspired by the community of innovative biotech researchers. To have the opportunity to speak in front of and be challenged by the expert judges, who were senior scientists and leaders of the field, was stimulating. I recall the judges treated the students like real "geniuses," as if we were colleagues, and did not reduce the level of our conversation to layman's terms, but rather explored the deep complexities of the academic material. The energizing experience I had at BioGENEius, as well as my research experience at Stanford, fueled my academic interest in the intersection of artificial intelligence and biology. After BioGENEius, I continued my research during my first two years in college, where I ultimately developed mRuby3, the brightest red fluorescent protein to date. I published my work as co-first author in two papers, and to this day, labs across the world use mRuby3 in their experiments. I never expected to see such results and am forever grateful for the mentorship I received from my professor, my research mentor, my high school teachers, and the judges at BioGENEius.

Last but not least, the BioGENEius Challenge was an oasis of mutual growth and friendship. I made new friends that I still keep in touch with today and are some of my closest friends. We often have intellectual conversations about mRNA for cancer treatment, chat about our latest "breakthrough" at the lab or have deep conversations about life aspirations or the new delicious dessert that we tried. These are friends who I know genuinely care about me and push me to challenge myself and make positive changes in my life. I am thankful for these lifelong friendships, that all started at the BioGENEius Challenge.

So, I am so grateful for Johnson & Johnson Innovation's strong commitment to the BioGENEius Challenge. I am also truly appreciative for the organizers of the BioGENEius Challenge for their creativity

and dedication in designing and executing the competition each year; their hard work makes this experience possible for all of us.

Thank you for supporting this unique challenge that enables us to build the foundation to become future scientists. The BioGENEius Challenge has been one of the driving forces towards my passion in biology and computer science, and my desire to invent useful tools to improve human health. I feel tremendously lucky to have had this rich and stimulating learning experience at such a young age, and I will never forget our memories from BioGENEius. It's been an honor to participate in the BioGENEius Challenge.

The content and views presented here are those of the individual Challenge participant.