I engaged in stereotypical "pre-engineering" activities as a youth: I carefully constructed colossal Lego masterpieces, designed sprawling, ancient civilizations on my computer and was an avid member of my high school's physics Olympics club. However, as a boy simply I revered anything that beckoned the imagination. I spent hours developing animated skits on PowerPoint, sketching the Philadelphia Flyers winning a Stanley Cup Championship or pretending I was Kobe Bryant in my backyard. In high school, I excelled in physics and calculus, but my true passion was for subjects that involved writing, philosophy and film. When I applied for college, I considered studying an assortment of disciplines including architecture, psychology, creative writing, video editing and neuroscience before carefully settling on engineering. In hindsight, my eclectic upbringing became an essential precursor to the interdisciplinary and big-picture researcher I am striving to become today.

I first realized that I wanted to pursue a career in sustainable or green engineering during my sophomore year of college. Huddled in the corner of the engineering computer lab, I quietly studied the documentary "Surviving Progress" as part of a homework assignment for my communications elective, Introduction to Argument with Taylor Hahn. I intended to adequately prepare myself for a class discussion by jotting down some brief notes about the argumentative tactics, imagery and styles utilized by the director. However, ninety minutes into the film, I peered down, finding my note pad still entirely blank. I was so captivated by the film's message about the environmental threats that mankind has produced—and is now forced to solve—that I completely forgot to take note of the film's more subtle cinematographic features. The film was my formal introduction to an interest in ecological crises and problem solving.

The next day, Mr. Hahn and some of my impressively acute communications classmates made me fully aware that my reaction was completely in accordance with how the film's underlying tactics are designed to manipulate its viewers. Nevertheless, I was determined to re-evaluate my perspective on sustainability and humanity.

That summer, employed as a financial analyst intern for a private equity firm, I watched TED talks that tackled urbanization and sustainability during my lunch breaks. Investigating concepts like MycoBond's organic packaging and insulation materials and WikiHouse's effort to apply the open source design movement to architecture, my interest became absorbed in technologies and systems that could alleviate the environmental strain that modern lifestyle amenities create.

When I returned to Pitt, I continued to foster my newfound perspective on our world. At first, I did so outside of my engineering efforts, casually watching documentaries, attending presentations and reading articles. However, following an eye-opening presentation on Eco-Innovation by renowned Pitt professor Dr. Eric Beckman, my interests became motivations. I was captured by Dr. Beckman's comprehensive understanding of technologies pertinent to the depletion of natural resources, greenhouse gas emissions and energy conversion. Not only did I want to cultivate this perspective within myself, but felt strongly that I could creatively contribute to ecological problem solving. Entering the winter, I took a more proactive approach to bestowing my efforts as an engineer to the development of green technologies by conversing with professors outside of class and ultimately pursuing undergraduate research.

In the spring of 2014, I applied for and accepted a position in the Mascaro Center for Sustainable Innovation's Undergraduate Research Program, studying the resilience of critical infrastructures as a member of Dr. Vikas Khanna's research lab. My research included a passenger data-driven, network theory analysis of the London Metro system as an example of resilience-building strategies applicable to transportation systems in polycentric megacities.

Using passenger data derived from Transport for London's Rolling Origin and Destination Passenger Survey, I idealized the railway system as a weighted network. Applying graph theory metrics, I determined that the criticality of the stations within the London metro followed a power law, whereby just a few transfer stations account for a massive amount of passenger flow. Building upon this, I created three novel algorithms that assessed the network's functional and topological response to various types of station or track failures. After imparting the algorithms to the network in MATLAB, we targeted specific areas to improve resilience within the metro.

What made this work meaningful to the emerging field of resilience is its applicability to infrastructures beyond the transportation sector. Network theory is a dynamic and widely applicable system of analysis. Thereby, the methods and insights gained by my study can be used to comment on the resilience of other critical infrastructures such the electric grid network, the food and agriculture sector and economic systems, as well as other world public transit networks.

I presented my work at the 2014 Mascaro Center Undergraduate Research Symposium, earning 2nd place overall. Dr. Khanna invited me to join his team as a co-lead writer and publish my summer analyses alongside my PhD student partner, Shauhrat Chopra. While taking classes, I worked in the lab for an additional six months until the winter of 2015. I am a lead writer in the finished manuscript, which recommends strategies to achieve fault-tolerance in urban transportation systems in a peer-reviewed article. The publication was submitted to *Scientific Reports* for review in early September.

Due to the novelty of existing work in resilience, I was able to inventively contribute to a crucial conversation about creating comprehensively sustainable large-scale systems and cities. Following this largely analytical and computing research experience, I specifically sought out a hands-on or experimental research experience. In the spring of 2015, I joined Dr. David Sanchez's Sustainable Design Lab as the project lead in "CEEnsors", a community based research project in its infant stages of development. My work is focused on democratizing and disseminating knowledge of indoor air and environments. My approach is to build low-cost, microcontroller-based air quality sensors, deploy them in commercial, community and residential settings and assess the performance of each sensor. I was awarded a University Honor's College Community-Based Research fellowship to support my research. My first step was locating and collaborating with a set of community partners interested in allowing me to use their indoor spaces. In my search, I was keen on finding local non-profits or organizations that provided benefit to the underserved sector of our community and occupied buildings with relatively high amounts of human traffic. Once our sensor hosts were secured, my work became much more technical. As a mechanical engineering major, I applied my coursework background in mechanical design, mechatronics and programming to the lab, building and calibrating carbon dioxide, dust, lux and temperature and relative humidity Open Source Building Scientific Sensors.

This fall, Dr. Sanchez hired a part-time undergraduate computer engineer, Tyler Protivnak, to work on CEEnsors under my supervision. This has given me the opportunity to act as a both an project lead and an undergraduate mentor, which is something I did not anticipate being able to do until reaching graduate school. Subsequently, working with Tyler has been a privilege, and I'm intent on pursuing similar leadership opportunities as a graduate student.

As Tyler and I finish our sensor prototypes, our current challenges include designing and 3D printing cases that will protect the sensors and allow for simplified installation and data extraction. Simultaneously, we are creating a deployment schedule that will validate the performance of our sensors while assessing the indoor air quality of our three community

partners: the Oakland Planning and Development Corporation, Community Health Services and People's Oakland. The data derived from the sensors will allow for evaluation of the results from a public health perspective while studying the relationship between building occupants and the microbial composition of their indoor environment. We will submit the results of our work for publishing in an academic journal in the winter of 2015-16.

In addition to my lab work in CEEnsors, this summer and fall I helped teach minority middle and high school students in various engineering topics including CAD software, circuits, programming and design. I conducted this outreach at two different programs and one inner-city school: The school of engineering's Investing Now, the Oakland Planning and Development Corporation's School 2 Career Program and workshop programs at the Manchester Academy School in Pittsburgh. This experience not only gave me a unique opportunity to help train the next generation of engineers and scientists, but also served as an enjoyable change from my daily activities. Fostering relationships with each student, sharing my experiences and understanding how they learn and create allowed me to return to the lab that night or afternoon with heightened energy and a smile. Further, internal lab group events such as quad-copter challenges, ice cream nights or group breakfasts allowed me to connect with Dr. Sanchez's research team on a more substantial level. The group is comprised of both engineering and life-sciences graduate and undergraduate students working in disciplines including microbial fuel cells, life cycle assessment, biofilms, aquaponics and engineering education. Learning how each of these projects work, and how they integrate with the motivations of my own work, has been one of the most eye-opening aspects of this research experience.

These experiences and endeavors, dating back to my days as a child, have sharpened my interdisciplinary and holistic approach to problem solving and led to my pursuit of a Ph.D. in civil engineering. I am committed to becoming an expert in technologies and systems pertinent to sustainable urban infrastructure, such as energy conversion, building design and transportation; and one day I will coordinate my own effective and innovative research initiatives as a principal investigator. Doing so, I will not only activate the same imaginative and thoughtful impulses that captivated me as a child, but I will also respond to the global imperative to strengthen and sustain our planet's ecosystems.