

Outstanding Outreach Award

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Biomedical Engineering Society
University of Pennsylvania

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The University of Pennsylvania chapter of BMES had many outreach activities over the past year, including our fourth annual Junior BioEngineer-Teach-Aspire (BETA) Day, SPARK mentoring, and the Rebuilding Philadelphia Together trip. This year, our graduate section also established an Outreach Cohort, a group of graduate students who regularly attend outreach events. The purpose of the Outreach Cohort is to plan outreach events that are the most appealing to our members and to ensure adequate attendance at events. We believe that our events this year have improved the sense of community between Penn bioengineering students and the surrounding Philadelphia neighborhoods, making us an excellent candidate for the Outstanding Outreach Award.

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I. Junior Bioengineer-Teach-Aspire (BETA) Day

Program Description

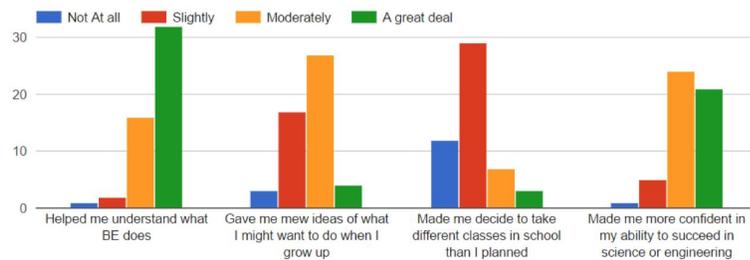
The graduate section of Penn BMES hosted its fourth annual Bioengineering Teach-Aspire (BETA) Day on January 27th, 2017. On BETA day we invite local middle school kids to Penn to participate in a day of bioengineering demonstrations and experiments. Students arrived in the morning and spent the day participating in activities hosted by various bioengineering labs. The Graduate Outreach Chairs planned BETA day in conjunction with iPraxis and our department’s administrative office. iPraxis is a local organization that works with K-12 students to open the doors of science and discovery to new generations through innovative educational programming, specifically in underserved communities.

Goals and Goal Assessment

The primary objective of BETA day was to inform students about the range of interesting things bioengineers do, and to inspire them to stay interested in science and math. To assess the efficacy of this objective, students filled out surveys during lunch to convey the value of participating in BETA day (below, left).

The secondary objective of BETA day was to determine how much information students understood throughout the day. This was done via a jeopardy board (below, right). At each activity, students were given five questions of varying difficulty to answer. The top three students were awarded science kits, and the top third of students were given other Penn gifts.

My participation in BETA day today



	Muscles	Organs on Chips	Bio-mechanics
100	What does EMG stand for?	_____ are the building blocks of all tissues in the human body.	Which material has a higher stiffness, bone or skin?
200	The _____ jerk reflex is activated by tapping the patellar tendon	_____ are structures in the human body that are made up of tissues and perform a specific function.	_____ is the unit engineers use for force or load.
300	An _____ is a device used to measure the precise acceleration of an object. (Hint: it's in the head of the reflex hammer)	The process of creating patterns of cells in a confined structure to create living tissues is called _____.	Engineers use mechanical testing to determine the _____ of materials in the body.
400	The individual fibers that make up a nerve and transmit electrical signals are called _____	_____ technology focuses on creating miniaturized systems to mimic the structure and function of human organs.	Cooked spaghetti would probably have a (higher or lower) _____ stiffness than uncooked spaghetti?
500	The _____ response happens faster than the _____ response	Flow in both microfluidic devices and blood vessels in the human body can be generated differences in _____.	During a mechanical test, force is plotted on the y-axis and distance is on the x-axis. How do you calculate stiffness?

Target Audience

The target audience for BETA day is middle school students from underserved areas of Philadelphia who have expressed an interest in math and science. This year, iPraxis organized for 60 students from four local Philadelphia schools (Belmont Charter School, Cook-Wissahickon School, Duckrey Tanner School, and Northwood Academy Charter School) to participate in BETA day. Teachers at each school select which of their students would benefit the most from participating in BETA day.

Chapter Participation

BETA day was planned by two graduate students. An additional 30 graduate and undergraduate students volunteered to assist with set-up, clean-up, assisting with individual activities, and escorting groups of students around Penn. A thank you lunch was held for the volunteers one week after BETA day, as BETA day could not run without the assistance of our volunteers. Over the years, most graduate students at Penn have volunteered to assist with BETA Day, and they have all found it to be a rewarding and fun experience.

Methods

Two graduate Outreach Chairs began planning BETA Day in early September. We worked with iPraxis to recruit students, while the department's administrative office helped us book rooms. In late October, we began soliciting labs to host events. All the labs had participated previously, and made slight alterations to their demos based on feedback from past years. Labs also provided questions for the jeopardy boards that students filled out during the day. We designed a BETA Day logo and had t-shirts made for all students and volunteers.

In early December, we began recruiting volunteers to help during BETA Day. In January, the department helped purchase food and snacks, prizes for jeopardy board winners, and other supplies (lanyards, folders, name tags, etc.). A few weeks before BETA day we contact the undergraduate Medical Emergency Response Team was asked to accompany students on BETA day in case of emergency. A couple weeks before BETA day, all EMG volunteers underwent a short training session to familiarize themselves with the EMG software and electronics. A detailed description of the events of the day are listed below.

- Introduction: When students arrived in the morning, they were given BETA day T-shirts and folders with information about bioengineering. The folders included worksheets for the day's activities, the post-BETA day survey, and their Jeopardy boards. Following check-in, students ate breakfast while Dr. Arjun Raj talked about using microscopy to image cell division.
- GRASP Lab: After breakfast, students were taken to the general robotics, automation, sensing and perception (GRASP) lab to learn about robots. This year, GRASP showcased their Baxter robot, which is used for industrial automation. Students got to play with the robot and ask questions about the other robots from the GRASP Lab.
- Instron Activity: In this activity, two students from our orthopedics labs demonstrated how to use an Instron machine to measure stress and strain. They used spaghetti and laffy taffy to demonstrate differences in stress and strain.
- EMG Activity: During the EMG demo, students were split into groups of 3 - 4. In the group, one student was attached to EMG, and other students would test that student's involuntary knee jerk reflex. The software allowed them to time the reflex and compare it to the response time of a voluntary reflex.
- Microfluidics Activity: During the microfluidics demo, 5 graduate students from Dr. Dan Huh's lab explained the value of microfluidics and showcased various projects from their lab. Students went around to multiple stations to learn about these projects.
- Lunch: Students were given a pizza lunch and were asked to submit their post-BETA day surveys and jeopardy boards. The jeopardy boards were graded at this time, and students who were to receive prizes were selected. Additionally, our group picture was

taken after lunch.

- Networks of the Brain Activity: Dr. Danielle Bassett, along with grad students from her lab talked about the inter- and intra-connectivity of networks in the brain, as well as other types of networks. She brought in ZomeTools and had students build networks that showed both the inter- and intra-connectivity of a network of roads.



Budget

The bioengineering department graciously covers all costs for this event

Breakfast	\$851.00
T-shirts	\$662.54
Pizza Lunch	\$350.00
Jeopardy Prizes	\$100.67
Folders, Lanyards, etc.	\$250.00
Total	\$2,214.20

Future Directions

BETA day is a highly successful event. Moving forward we would like to invite more students from more schools in the Philadelphia area. Additionally, we would like to continue improving our demos to make them more hands-on and accessible to all knowledge levels in future years. Next year, we plan on sending teachers who participate in BETA day a packet of information to cover with their students before BETA day, so students are better prepared to understand the activities.

II. Spring SPARK Mentoring

Program Description

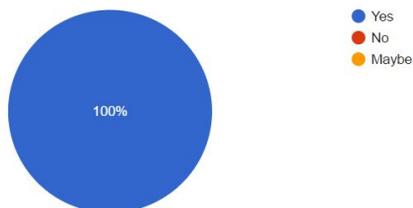
SPARK is a mentoring program that pairs at-risk middle school students with mentors who work in a field that interests them. Teachers recommend students for SPARK if they notice the student struggling academically in school, and SPARK boasts a high school graduation rate of over 90%. Graduate students served as mentors. Mentors spend two hours

a week for 10 weeks working on a project that combines the student's interests and their mentor's expertise.

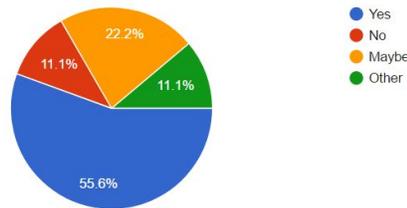
Goals and Goals Assessment

For mentors, the goal of SPARK mentoring was to work with a middle school student, build a relationship with them, and inspire them to consider new career paths. Mentors who participated all had positive experiences. All mentors said they found the experience valuable and more than half said they would be SPARK mentors again next year.

Did you find your SPARK mentoring experience rewarding?
9 responses



Would you be a SPARK mentor again next year?
9 responses



Target Audience

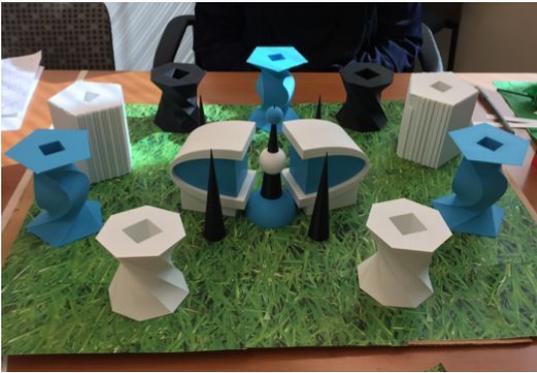
SPARK mentoring is targeted towards middle school students who are struggling in school, either academically or socially. Our mentors were partnered with students who have specifically shown an aptitude for or an interest in math and science.

Chapter Participation

This year, 11 graduate students in bioengineering volunteered to mentor 10 middle school students from the Henry C. Lea Middle School.

Methods

On average, mentors spent between \$20 - \$40 on their SPARK projects. Mentors spent every Tuesday from 3 - 5 PM working on their project with their mentee, and they spent 15 - 30 minutes preparing for the week's SPARK session. Examples of SPARK projects include building a flying helicopter, studying how cells migrate in culture, studying building stability during earthquakes, and designing buildings in SolidWorks and 3D printing them (see below).



Future Directions

In the future, we will continue to promote SPARK mentoring. Both the graduate students and the middle school students enjoyed building their SPARK projects and hopefully, more graduate students take on mentoring roles in future years. We feel the SPARK experience for graduate students is especially meaningful relative to our one-term outreach events because it provides a longitudinal mentoring experience with local middle school students.

III. Fall SPARK Lab

Program Description

Our graduate section designed an activity for the fall SPARK lab that used Legos to help students understand the intricacies of coding. Students had to write instructions on how to build a Lego structure with enough detail for a peer to recreate the same structure. This is meant to represent how coding requires a user to write directions in a language that the computer can interpret, and how deviation from the language leads to failure of the code. In addition, the GRASP lab talked to students about robotics and graduate student volunteers worked with students on the soft skill of mapping one's future.

Goals and Goals Assessment

The general purpose of the SPARK lab is to expose students to different career options. The purpose of the Lego activity was to help the students understand the intricacies of coding while having fun. A few days after the activity, our SPARK coordinator informed us that he had "two students tell me today that it was their favorite field trip and that they want to come back."

Target Audience

The target audience was middle school SPARK students. However, we can modify the activity for older students by using more Lego pieces per structure.

Chapter Participation

Ten graduate students worked with students one-on-one to help write and interpret instructions.

Methods

We purchased a \$20 pack of 500 assorted Lego pieces for this activity. Volunteers spent an additional hour helping with the activity, as well as 30 minutes preparing beforehand. Students were given pre-built Lego structures made of 5 - 6 pieces and told to write instructions for how to build the structure. Graduate students worked one-on-one with students to help them write instructions. They advised the middle schoolers on how to use a coordinate system, Lego size and color, and descriptions of the final object to make their instructions clear. Then, they passed the instructions and Lego pieces to a peer, who used the instructions to re-assemble the structure. Once built, they compared their final creations to the original structure and discussed possible improvements to their instructions.



Future Directions

We plan on using this activity again next year for SPARK's engineering Lab; however, a short presentation on best practices when writing directions will improve the accuracy of the final structures. For example, most students chose to write their instructions as a paragraph instead of a list of commands.

IV. Northwood Outreach Lecture

Program Description

As a follow-up to BETA Day, all participating schools were given the option of having graduate students give an in-class lecture or lead an activity. Northwood Charter School asked us to give a one hour lecture on a topic of our choosing to a group of their middle school students. Two graduate students gave a lecture about prosthetics and bioengineering to a group of 80 students.

Goals and Goals Assessment

The goal of this lecture was to follow-up on the excitement that students show for bioengineering after BETA day. The concept was to have a continuing relationship with these students so that BETA day is not just a one-day field trip. Students and teachers at Northwood enjoyed the lecture and would like us to return in the future.

Target Audience

This lecture was targeted to middle school students.

Chapter Participation

Two graduate students participated in this event.

Methods

No funds were necessary for this event. The two graduate students spent 5 hours preparing and delivering the presentation. The presentation was designed to be highly engaging for students and included many videos and images to ensure engagement. The presentation started with a brief introduction to different types of bioengineering: biomechanics, tissue engineering, synthetic biology, bioimaging, and biotransport. This was followed up by more detailed discussion on how the engineering process has developed improving prosthetics over time, and how car crash dummies are used as tools to understand biomechanics and prevent injury. Students were engaged throughout the entire talk and asked questions frequently.

Future Directions

Since Northwood's teachers have expressed interest in having GABE return to deliver this lecture in future years, it might be helpful to expand our lecture to include a short demo, in addition to the many videos and images we showed this year.

V. Relay for Life Fundraiser

Program Description

Relay for Life is the primary fundraiser for the American Cancer Society. The purpose of the program is to remember those who have passed due to cancer, to honor survivors, and to raise money for the American Cancer Society. We raised \$1,000 towards the cause.

Goals and Goals Assessment

Our goal was to create a Bioengineering Relay for Life team and raise money for this fundraiser. We set out to recruit Bioengineering students and staff to join our team and acquire donations. We also planned on holding multiple fundraisers to raise money for this cause.

Target Audience

The target audience was all BMES members, as well as the broader Bioengineering community at Penn.

Chapter Participation

We had 100% chapter participation. Every member of BMES joined the BE Relay for Life team and helped raise money throughout the year. They all also contributed their time to work at the multiple fundraisers we organized.

Methods

Our main two goals were to recruit members for our Relay for Life team and to raise money. In order to accomplish our goal of building a strong team, we created a Facebook event to share with all the Bioengineering students. We also sent out emails to the Bioengineering students and staff with this same information. In total, we spent 10 hours doing this. To accomplish the second goal of raising money, we organized multiple fundraisers. This included setting up profit-shares with restaurants such as Ben & Jerry's and Chipotle. We also held bake sales where we sold desserts prepared by BMES board members. In total, these projects comprised around 50 hours.

Future Directions

In the future, we are very excited about continuing our commitment and effort to support Relay for Life. We plan on creating another Bioengineering Relay for Life team and on working to raise money to support the American Cancer Society. The profit-shares with restaurants were a very easy and successful way to raise money so we will continue this next year. The bake sales were also very successful fundraisers that allowed all members of BMES to get involved, so we plan on also continuing these events. In thinking about building our BE Relay for Life team, we will continue to use social media as a way to get participants. However, we plan to start these recruitment efforts earlier in the year to create the biggest team possible.

VI. Rebuilding Together Philadelphia Build Trips

Program Description

Rebuilding Together Philadelphia (RTP) is an organization that hosts block builds multiple times a year. RTP will choose one block in an underserved region of Philadelphia and repairs all the homes in this area over the course of a weekend. Many of these homes belong to older residents who are both financially and physically unable to maintain their homes. This year, GABE participated in two RTP trips, one in the fall and one in the spring.

Goals and Goals Assessment

The goal of this event was to get graduate students invested in helping underserved members of the Philadelphia community. Because the fall build wasn't well attended compared to the spring build, we will probably only participate in the spring build in future years.

Target Audience

The target audience of this event was members of the Philadelphia community who can no longer afford to maintain their homes.

Chapter Participation

On October 22nd, four graduate students helped clean a house and repair flooring. On April 3rd, seven graduate students repaired a home by installing a new drywall ceiling in the kitchen and fixing flooring on the second floor.

Methods

This event was well organized and easy for us to participate in. Volunteers were fed breakfast in the morning, so the cost was minimal.

Future Directions

Participation in RTP is a full day commitment, which does hinder participation from graduate students. Because attendance was low, we plan on creating shifts for our volunteers. Additionally, we may only participate in one build during the year, since there was little interest for participation in the fall.

VII. LOVE Your Park – Park Cleanups

Program Description

The Philadelphia Parks and Recreation Department host a week-long park clean-up twice a year. Volunteers can choose a park to help clean and restore, so that residents can enjoy the park during the year. This year we sent graduate student volunteers to a fall park clean-up at Mifflin Square and a spring park clean-up at Lardner's Point. Both parks were chosen because the Parks and Recreation Department those parks did not have enough volunteers.

Goals and Goals Assessment

The goal of this event was to get graduate students to help the Philadelphia community clean its parks. While interest in these events were low, participating students really enjoyed the event and appreciated that we organized this event.

Target Audience

The target audience of this event was the members of the community who enjoy Philadelphia parks.

Chapter Participation

Our chapter sent four graduate students to clean Mifflin Square and six graduate students to clean Lardner's Point.

Methods

Both park clean up days lasted from morning until early afternoon, and did not cost anything. Volunteers drove to the park and helped plant grasses, pick up trash, cut weeds, and

repair and paint a bench. The event organizers provided snacks for the day and instructions on what needed to be done.

Future Directions

We plan on participating in this event in future years.