

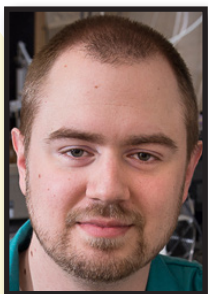
Rigorous - Educational - STEM Focused - Hands-on - Fun

*All Gelfand Outreach Fall Saturday Series Classes are \$50 per class.*

*Scholarship funds are available through gifts from several Carnegie Mellon alumni. Please see page 6 to learn more.*

## AMAZING ATMOSPHERE, GRADES 4-5

9am - noon, November 4th



Do you know why the sky is blue? This workshop will teach you all about our atmosphere and our climate system. Have you ever explored the topic of climate change? We will talk about why climate change is important and what we as a community can do to make our world a better place. We will do a number of fun hands-on activities exploring cloud formation and light scattering.

*Michael Polen is a 5th year Ph.D. student in the Mellon College of Sciences Department of Chemistry and works as a member of the Center for Atmospheric Particle Studies at Carnegie Mellon University (CMU). He is a former president of the Future Leaders of Science at CMU, which performs science outreach at local schools in the Pittsburgh region. Michael's current research focuses on the impact of wildfires and prescribed fires on cloud formation and precipitation. He earned his Bachelors of Science in Chemistry at Widener University in 2013.*

## ARCHITECTURE WITHOUT WALLS, GRADES 3-4

9am - noon, September 23rd

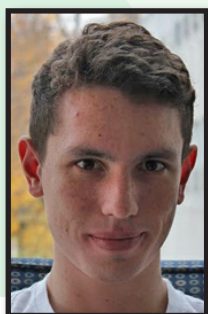
How do architects design the spaces between buildings? In this workshop, students explore landscape architecture concepts, such as topography, horticulture, and sustainability, while creating their own park with a playground, garden, and pavilion.

*Kelly Li is currently an architecture student at Carnegie Mellon University with interests in design and education. She has previous experience teaching students aged five through thirteen at Carnegie Mellon's School of Architecture Saturday Sequence, Carnegie Museum of Art, and Pittsburgh Public School's Summer Dreamers Academy. Through teaching, she hopes to inspire others to not only learn from their surroundings, but also discover methods to positively influence those environments.*



## BUG-BOTS, GRADES K-2

9am - noon, October 21st



Bounce your way into the exciting world of robots! Explore motion, power, electricity, and robots. Discover the way motors and batteries operate. Discuss robots and bugs and then create a robot, explain how it moves, and take the robot home to share with your family and friends! Parents are invited into the class at 11:45 for a Bug-Bot parade of all the class creations.

*Christopher George is a sophomore Electrical and Computer Engineer at Carnegie Mellon University (CMU). He has an intense interest in education, which has led to the creation of a number of personal papers delving into topics about how and why students learn, and what the most effective means of education are. He has been a teaching assistant for the Fundamentals of Programming and Computer Science class at CMU. He also currently volunteers for a group called Teknowledge, which is focusing on creating a curriculum and outreach program through Carnegie Mellon to support local high schools and teach computer science and programming.*

## BUILDING UP!, GRADES 3-5

9am - noon, November 4th

From concept sketch to building, skyscrapers must be designed with geometry and physics in mind. Learn the math, science, and design behind skyscrapers. Work as a team and work individually to add to Pittsburgh's skyline. How can a new skyscraper be inspired by geometry found in native Pittsburgh plants? Come discover and build!

*Kelly Li is the instructor for this class. Please see her biography above.*

## CAMERA ENGINEERING, GRADES 5-7

9am - noon, October 21st

Building your own camera is not just fun, but good engineering practice. The workshop will be comprised of short lectures on four topics: history of imaging, basics of optics and photography, power-generation and storage, and operating principles behind a modern digital camera. Students will then build their own camera and, weather permitting, will go for a hike to use their newly built cameras to take photographs. Tips will be provided to help them explore unusual framing concepts and achieving artistic effects.



*Dr. Aswin Sankaranarayanan is an Assistant Professor at Carnegie Mellon University (CMU). He earned his Ph.D. from University of Maryland, College Park where he was awarded the distinguished dissertation fellowship for his thesis work by the ECE department in 2009. Aswin is currently the PI of the Image Science Lab at CMU (<http://imagesci.ece.cmu.edu>), whose research consists of a diverse portfolio, ranging in topics from optics, computer vision, and image processing. He has received best paper awards at the CVPR Workshop on Computational Cameras and Displays (2015) and Analysis and Modeling of Faces and Gestures (2010). He has given a keynote talk at the IEEE Computational Cameras and Displays Workshop (2015), as well as invited talks at a number of conferences.*

## ENGINEERING 101, GRADES 5-7

9am - noon, September 23rd

What is engineering and how do engineers design new systems and products? Engineering marvels are all around us, and are essential parts of our everyday lives. In this class we will explore the engineering design process and how engineers overcome challenges of mechanics, environment, and change. Students will face an engineering challenge, design and test a solution, and more importantly “re-design” to improve on the original idea. Students will see how fundamentals of math and science are used in the engineering design process as well.

*Dr. Deanna H. Matthews is Associate Department Head for Undergraduate Affairs and Assistant Teaching Professor in Engineering and Public Policy (EPP), and Education Director and researcher in the Green Design Institute (GDI) at Carnegie Mellon University. In her role in EPP, Dr. Matthews oversees the undergraduate programs. In the GDI, an interdisciplinary research center that focuses on the intersection of environmental and economic issues, her research centers on the development and deployment of the Economic Input-Output Life Cycle Assessment tool, examining energy life cycles of new products, corporate environmental management, and educating general populations about energy-environment issues. As Education Director, she oversees education and outreach initiatives for the GDI. She is the coordinator and instructor of outreach programs to K-12 students and teachers in school settings and informal educational events. She received her B.S.E. in Civil Engineering from Duke University (1994) and her M.S. (1995) and Ph.D. (2001) in Civil and Environmental Engineering from Carnegie Mellon University.*



## ENGINEERING FOR SUSTAINABILITY: TINY HOUSES, GRADES 5-6

9am - noon, October 21st

Have you been building things for as long as you can remember? Learn about civil engineering and architecture as we talk about ‘tiny houses.’ We will look at two different configurations of tiny houses: a rectangular shape and a geodesic dome. We will learn about sustainability and what makes a tiny house sustainable. Using math, we will talk about how the size of the rooms in a tiny house compares to your own home and how to live with less ‘stuff!’ You will build a model of a geodesic ‘tiny house,’ and we will talk about the geometry that gives a geodesic dome its structural strength.



*Dr. Deborah Lange is an environmental engineer that has worked in academia as well as in small and large businesses. Currently, she is the Director of Special Environmental Project for the Steinbrenner Institute at Carnegie Mellon, where she has been for the last 17 years. She is a graduate of The Pennsylvania State University (BS, Civil Engineering) and Carnegie Mellon (MS and Ph.D., Civil and Environmental Engineering.) Deb is active in the Pittsburgh community as a Director on the Board of the Allegheny County Conservation District and is a past president of the Engineers’ Society of Western Pennsylvania. She also enjoys ‘STEM’ outreach and is working with Propel Charter high schools as well as the Sarah Heinz House Boys and Girls club. Deb has 3 adult children: a medical doctor, an architect, and an environmental engineer. She enjoys tinkering at TechShop and international travel with her husband, including motorcycling adventures in Europe, Africa and Cuba.*

## **INSECT DWELLINGS,** GRADES K-2

9am - noon, November 4th

Ever wonder where insects live? Is it on a leaf, in a hive, or perhaps in an underground tunnel? In this introductory architecture class you will discover how insects of all kinds live. Explore the structure and habitat which they live within. You will be able to select insects from ants, ladybugs, or even butterflies and then design a home in which your small friend can live!

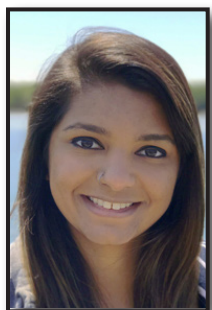
*Elizabeth Levy is currently a fourth year student in Carnegie Mellon University's School of Architecture. She has taught children K through 7th at the Carnegie Museum of Art, Anvil Art Studio, Camp Invention Program, Phipps Conservatory Discovery Center, and presented Sustainable Living Research to several class rooms of students in Pennsylvania. She has a background in art, design, and horticulture with interests in Biology, Sustainability, and Education. As a member of CMU's Architectural Outreach Program, Elizabeth's focus is to instill in children the importance of S.T.E.A.M. ideals and introduce architecture at a young age.*



## **INTRODUCTION TO MOTION PLANNING,** GRADES 6-8

9am - noon, October 21st

Ever wonder how robots are able to move around without bumping into obstacles? How are self-driving cars able to get from their current location to another location? Motion planning is a field of Robotics that develops algorithms to plan motion of a robotic system to move from one point to another. In this class, we will discuss the basics of search-based planning, a specific motion planning method that is used in robotics to address the following question: How can robots efficiently plan a path to move from point A to point B without colliding with obstacles? We will also have a role-play activity where we act out how some of these algorithms find a path. Finally, we will visit the Search-Based Planning Lab to see real-world applications of these algorithms on robots!



*Vinitha Ranganeni is a third year undergraduate student at Carnegie Mellon University pursuing a Bachelor's of Science Degree in Information Systems and Robotics. She is also an undergraduate researcher at Carnegie Mellon University's Search-Based Planning Lab and is advised by Professor Maxim Likhachev. Her general research interests lie in Robotic Manipulation and Motion Planning. Previously, she was an undergraduate researcher in The Personal Robotics Lab where she was advised by Professor Siddhartha Srinivasa and worked on projects with HERB, the Home Exploring Robot Butler. Vinitha participated in several outreach events with children and underprivileged students where she talks about Robotics in general and the specific work both she and her lab are doing.*

## **MARVELOUS MACROMOLECULES,** GRADES 3-5

9am - noon, October 21st

The existence of life is dependent upon nature's ability to manufacture very large, complicated molecules such as DNA and proteins. The ability of chemists to prepare really big molecules called polymers in the laboratory has revolutionized the manner in which we live. In this workshop, students will explore a variety of polymers, their usefulness, and how to make them in a manner which demonstrates care for the environment. This hands-on workshop will have students working in the lab and participating in lecture demonstrations to explore the amazing world of polymer chemistry.

*Dr. Gizelle A. Sherwood is currently an Assistant teaching Professor at Carnegie Mellon University. She earned her Ph.D. in 2008 where her research focused on the effects of aggregation on the photo- physics of oligomers related to MEH-PPV and CN-PPV. She primarily lectures Quantitative Chemical Analysis laboratories to the sophomore chemical engineering, biology and pre-med students. She is also involved in several outreach programs working with both the Boy Scouts of America and the Leonard Gelfand Center.*



## MECHANICAL ROBOT GRIPPERS, GRADES 6-8

9am - noon, November 4th

The field of Robotics is a combination of mechanical engineering, computer science, and electrical engineering. This hands-on workshop will give students a taste of the mechanical side of robotics. Students will be able to interact with one of the robots developed at CMU called the Multipurpose Mobile Manipulator (MMM). In small groups, students will design a gripper for the robot out of Legos, and then test out their design by controlling the robot to see how well it performs specific tasks.

*John likes to introduce himself by saying he is a robot programmed with a singular mission: To effectively engage and inspire the next generation of STEM talent. Having graduated with a Bachelor's degree in Computer Science and Arts at*



*Carnegie Mellon University in 2017, John has over 9 years of experience developing computer simulations using a variety of programming languages and 4 years of experience building robots at CMU. In 2016, as an Innovation Scholar from the Center for Innovation and Entrepreneurship at CMU, John Choi founded an educational technology company called Choitek in Pittsburgh, PA. Choitek's flagship product is the Multipurpose Mobile Manipulator Mk II, (or Megamark for short), an advanced robotics platform designed to be capable of performing a variety of human-size tasks, such as watering plants, playing the piano, feeding pets, delivering coffee, and most importantly, teaching and inspiring students with its easy-to-use and accessible hardware. John Choi volunteered at the Carnegie Science Center, AssemblePGH, and Carnegie Mellon's Leonard Gelfand Center, Project Ignite, Robotics Club, and several middle and high schools, and was awarded the Gelfand Student Service Award in 2017. John is truly an artist, engineer, and entrepreneur all in one.*

## NANOENGINEERING WITH DNA, GRADES 4-6

9am - noon, October 21st

Did you know that DNA can be used to make tiny nanostructures and nanomachines? Engineers can design structures that are 1/1000th the width of a single hair and these structures will build themselves under the proper conditions. Professor Taylor will introduce students to structural DNA nanotechnology. Students will physically interact with both the chemical structure and mechanics of DNA, acting like nanomanufacturing engineers who treat DNA as an engineering material. They will build DNA double helix models from pasta and then as the focus of the class they will build scale DNA origami models of double helical rafts and nanotubes using pipe cladding and lasercut wooden connectors (using a kit designed by the Taylor lab students).

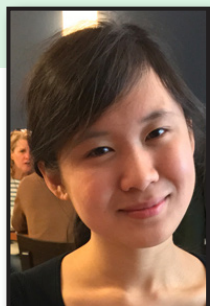
*Rebecca Taylor is an Assistant Professor in Mechanical Engineering at Carnegie Mellon University (CMU). She also holds a courtesy appointment in the Biomedical Engineering department at CMU. Prof. Taylor received her B.S.E. in Mechanical Engineering from Princeton University and her M.S. and Ph.D. in Mechanical Engineering from Stanford University. During her doctoral research she worked with Professor Beth Pruitt developing microscale force sensors for studying the mechanics of stem-cell derived heart muscle cells. She was subsequently a postdoctoral fellow in Biochemistry at the Stanford University School of Medicine, working under the supervision of Professor James Spudich. She is the director of the Microsystems and Mechanobiology Lab and her research team uses micro- and nanoscale structures as sensors and actuators for investigating the mechanics of cellular and molecular biosystems.*



## OUTER SPACE ARCHITECTURE, GRADES 3-4

9am - noon, October 21st

Space architecture has long been a subject of fascination since the founding of NASA. Now, as more space probes and satellites are sent further and further past Earth, new resources and habitable worlds have been discovered. The architecture that the students will design over the course of these lessons will run on limited materials in isolated environments in space. If a house can sustain two people on Mars, it can certainly do the same for two people on Earth. As resources are stretched further and further on Earth, it is important to learn about their value and how to recycle them.



*Victoria Yong is a 5th year architecture student at Carnegie Mellon University with a double-minor in Intelligent Environments and architectural history. She designed and tested the Outer Space Architecture curriculum for the CMU EQUIP Backpacks program. In her spare time, Victoria enjoys crocheting, cartooning, writing, and running.*

## **ROLLING ALONG,** GRADES K-2

9am - noon, November 4th

Learn how engineers solve problems and create new solutions. Discover potential and kinetic energy. Use your new knowledge and skills to plan and construct your own roller coaster model, complete with curves and upside-down loops. In this class, you'll use learn about forces like gravity and thrust that enable roller coasters to "roll." Welcome to Rolling Along, where speed and momentum are your new best friends!

*Paula Arambel is a GEM Fellow and Mechanical Engineering Ph.D. student at CMU. She is the President of the Mechanical Engineering Graduate Student Organization, and she serves on the Executive Board of the Women in Mechanical Engineering Society. Paula is from Boston, MA and received her B.S. in Mechanical Engineering from Northeastern University with a minor in BioMechanics. Her current research at the Microstructures and Mechanobiology Lab at CMU, focuses on a new microfabrication technique aimed at planar stretchable electronics.*



## **SOLAR ENERGY,** GRADES 4-6

9am - noon, September 23rd



You've heard that the sun can provide enough energy to power the whole world, but how is that energy harnessed? Why isn't this powerful, renewable, clean energy source used more often? Learn the basics of heat and how solar energy is used today, how a solar furnace can be used to heat your house in the winter and build your own solar hot water heater to take home with you to share. Solar energy, it's hot!

*Kristin Lavery has been the Assistant Director of the Leonard Gelfand Center (LGC) for Service Learning and Outreach since January of 2013. She joined the LGC after completing her Master of Arts in Teaching (grades K-6) at Chatham University in December of 2012. Kristin coordinates tutoring programs in the local Pittsburgh area where CMU students act as after school tutors, or teaching assistants and mentors in classrooms. Kristin also develops activities and workshops for presentation at schools and K-12 STEM related events in the area.*

## **TINY HARD WORKING GUYS,** GRADES K-2

9am - noon, September 23rd

This workshop will show the students how microscopic organisms can do a fantastic and effective job transforming certain chemical compounds into gasses among other things. We will use the Baker's yeast to produce CO<sub>2</sub> and O<sub>2</sub>. The first is produced by making the yeast eat sugar and the second by attacking the yeasts with hydrogen peroxide. Gases are invisible but we will find ways to demonstrate how they are formed. Our hands-on experiments will involve feeding sugar to the yeasts; preparing fluffy dough and making a foamy mess with soap water. It will be a lot of fun!

*Dr. Gloria Silva is an Assistant Teaching Professor in the Chemistry Department at Carnegie Mellon University (CMU). Gloria received her B.S. in Organic Chemistry and Pharmacist degrees from the National University of Cordoba (UNC), Argentina. At UNC she was an Assistant Professor with tenure and a Researcher of the Argentinean Research Council. She performed research in Bioactive Natural Products from plants. Gloria and her family moved to Pittsburgh in 2002 and she has been at CMU since. She was involved in research in the field of Bioorganic Chemistry and has been teaching undergraduate and graduate courses since 2008. Her courses have a main focus on Organic Chemistry and courses that teach concepts at the interface between Biology and Chemistry including a course on Food Science.*



## **USE YOUR NOGGIN:LEARN THE BRAIN,** GRADES 6-8

9am - noon, September 23rd



Come explore your brain and senses. In this workshop you will have the opportunity to learn about the electrical and chemical signals that drive your brain to see, hear, feel and think. We will have hands-on demonstrations allowing you to explore your amazing brain in action and see some surprising ways in which your senses get things right and other ways that your senses can be fooled. We will also get to look inside a brain by seeing a pre-dissected real sheep's brain so you can see the ways that your brain is similar to and different from another animal's brain in its structure.

*Dr. DJ Brasier is an Assistant Teaching Professor of Biological Sciences specializing in neurobiology. He was trained in brain physiology and genetics at University of California San Diego and UC San Francisco. He has been teaching neuroscience at CMU since 2012 and involved in community outreach for many years.*

## WEARBLE COMPUTERS, GRADES 7-9

9am - noon, November 4th

Bracelets that buzz, scarves that sense, ties that talk, blouses that blink— it's all part of wearable engineering! Students will learn about the rapidly developing field of wearable technology, and will design their own conductive fabrics and simple-to-program electronics. They'll also learn how humans and computers interact to form wearable technology, also known as "soft robotics". This class will inform and excite students about this electrifying subfield of mechanical engineering in our constantly upgrading world.



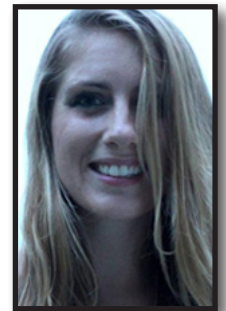
*Eric Markvicka is a Ph.D. candidate in the robotics institute where he is working with Prof. Carmel Majidi to explore a new class of multifunctional wearable electronics for biomonitoring. Eric received his M.S. degree in robotics from Carnegie Mellon University in May 2017. Prior to arriving at CMU, Eric received his B.S. and M.S. degrees in mechanical engineering from the University of Nebraska-Lincoln where he worked with Prof. Shane Farritor to develop fully insertable surgical robots for minimally invasive abdominal surgery. While at UNL, he was an intern at the Jet Propulsion Laboratory, Johnson Space Center, and Honeybee Robotics. He is a recipient of graduate research fellowship awards from the National Science Foundation (NSF) and the Center for Machine Learning and Health (CMLH) at CMU.*

## WRITE-ON SCIENCE, GRADES 1-2

9am - noon, September 23rd

Discover Bioluminescence, Light Emitting Diodes (LEDs) and Poetry! Everyone loves fireflies that light up at night, but did you know lots of different animals glow and light up, including fish, mollusks, bacteria, and mushrooms? Learn how these animals and fungi use their lights for good and for hunger! And they're not the only ones who benefit from bodies that light-up. Discover how scientists are using bioluminescence to help solve problems in our world. Bioluminescent trees instead of street lights? Glow-in-the-dark exit signs? It could happen! Adventure into uncharted territory as you create your own bioluminescent creature using LEDs and solar pigment, and write on science in the form of an ode poem to your favorite glowing creature.

*Christa Romanosky is a writer and educator. She has been working with the Gelfand Center for Service Learning and Outreach for over two years. She has a master's degree from the University of Virginia and a B.S. and B.A. from Carnegie Mellon University. She has taught classes for Gelfand Outreach and other workshops and K-12 courses for over nine years, creating engaging and fun curriculum for all learners.*



## PARENT SESSION: How to Survive a Science Fair Project

9:30am - 11:30am, November 4th

Participating in a science fair is a great way for young people to experience the thrills and challenge of "doing" science. Student participants learn first-hand about the scientific method and they get involved in an in-depth investigation that will challenge their creativity and persistence. It may be difficult for an elementary or middle school teacher to dedicate enough time to help individual students prepare their projects, so it is important for parents to be informed about science fairs. Discuss topics such as: How do you pick a good project? What science fairs are available to students in the Pittsburgh area? How do you sign up for them, and what are the expectations for students? Our presenters are Dr. Conrad Zapanta, Associate Department Head of Biomedical Engineering, Carnegie Mellon, and Dr. Laura Zapanta, Lecturer II in Biological Sciences, University of Pittsburgh. Both presenters have experienced science fairs from the perspective of a judge, an organizer and a parent.



## Gelfand Outreach Fall 2017 Saturday Series Classes

*Classes are \$50.00\* each and are conducted from 9am to noon at Carnegie Mellon University.*

### September 23rd

Tiny Hard Working Guys, Gr. K-2  
Write-On Science, Gr. 1-2  
Architecture Without Walls, Gr. 3-4  
Solar Energy, Gr. 4-6  
Engineering 101, Gr. 5-7  
Use Your Noggin:  
Learn the Brain, Gr. 6-8

### October 21st

Bug-bots, Gr. K-2  
Outer Space Architecture, Gr. 3-4  
Marvelous Macromolecules, Gr. 3-5  
NanoEngineering with DNA, Gr. 4-6  
Engineering for Sustainability:  
Tiny Houses, Gr. 5-6  
Camera Engineering, Gr. 5-7  
Intro to Motion Planning, Gr. 6-8

### November 4th

Insect Dwellings, Gr. K-2  
Rolling Along, Gr. K-2  
Building Up!, Gr. 3-5  
Amazing Atmosphere, Gr. 4-5  
Mechanical Robot Grippers, Gr. 6-8  
Wearable Computers, Gr. 7-9  
Parent Session

*\*To apply for scholarship funds, please submit a copy of the first page of your IRS 1040 tax form from 2016.*

5000 Forbes Avenue, Wean Hall 4612, Pittsburgh, PA 15213 - 412-268-1863

<http://www.cmu.edu/gelfand> - [GelfandCenter@andrew.cmu.edu](mailto:GelfandCenter@andrew.cmu.edu)