

GELFAND OUTREACH

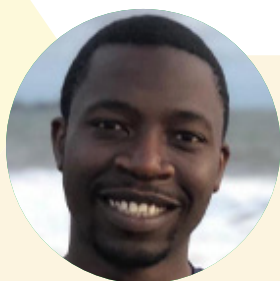
Rigorous - Educational - STEM Focused - Hands-on - Fun

Fall 2022 Saturday Series Classes - Carnegie Mellon University

All Gelfand Outreach Fall Saturday Series Classes are \$55 per class from 9AM to noon. Scholarship funds are available through gifts from several Carnegie Mellon alumni. Please see last page to learn more.

NOTE: Strict COVID-19 mitigation requirements will be in place; we will be following CMU protocols which may include mandatory vaccination, wearing masks, and/or social distancing depending on recommended guidelines at the time of the class.

There is NO eating or drinking allowed in classrooms during Gelfand Outreach programs.



Keith Phuthi

BATTERIES! GET WIRED! GRADES 4-6

October 15th

Batteries are in cell phones, remote controls, watches, cars and basically every device! If you've ever wondered what makes batteries work, this is the place to do it. This workshop will introduce the basics of how batteries are sources of energetic electrons which are used to power devices. The basics of circuits, voltage, charge and current will be introduced and related to energy and power through hands-on activities. Students will get to use and measure properties of different batteries and learn how to choose the correct battery for a given application.

Keith Phuthi is a graduate student in mechanical engineering at CMU and has an undergraduate degree in physics from MIT. His research focuses on computational modelling of materials for applications in energy storage devices such as batteries and is interested in energy systems in general. He has a passion for giving people from diverse backgrounds exposure to accessible science in the hope of spurring their interest. He believes that while learning will not always be easy, it can always be enjoyable with the right environment, motivations, and people around students. Keith has consistently taught K-12 students in various programs since 2015.



Caroline Holmes

BUG BOTS GRADES K-2

September 24th OR November 5th

Bounce your way into the exciting world of robots by exploring motion, power, and electricity. 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 to attend the Bug Bots parade at the end of class.

Caroline Holmes is a third year Dramaturgy major, minoring in English Literature and Culture. At CMU, she is involved in theatrical productions through the school of drama, and with student-led theatre across campus through Scotch'n'Soda and other independent projects. She works for the Leonard Gelfand Center as a Teaching Assistant and as a video editor for LGC virtual programs such as the GO STEM Show and other remote educational videos. As the daughter of an educator, she has always had a passion for education and creating opportunities for hands-on learning experiences for young students. In her free time, she enjoys dancing, singing, playing the violin, and crafting fun art projects!



Yves Georgy Daoud

BUILD AN AUTONOMOUS ROVER GRADES 5-7

September 24th

Have you ever wondered how robots on Mars navigate and explore the planet on their own? How do they sense the environment around them and avoid obstacles? This session will introduce you to the basics of robotics exploration by discussing perception and motion planning applied on a planetary rover. Use those skills to build and code a small robotics rover that perceives and avoids obstacles just as it would on other planets!

Yves Georgy Daoud is a second year master's in science student at the Robotics Institute of Carnegie Mellon University. He is a member of the Resilient Intelligent Systems Lab (RISLab) where he works on improving the performance and safety of robots operating in challenging real-world conditions through state estimation under uncertainty. Before that, he graduated in 2020 from the American University of Beirut - Lebanon with a degree in mechanical engineering where he worked on interdisciplinary projects such as a concrete 3D printer, beehive monitoring system, delta robot for pick and place applications, and a smartphone app for road quality and CO2 monitoring. In his free time, he enjoys reading books, hiking in nature, and going caving.



Alex Gourley

BUILDING BLOCKS OF 3D PRINTING GRADES 3-5

November 5th

What do Legos, sandcastles, and 3D printing have in common? In this workshop, we will explore how building up layers of material forms the foundation behind 3D printing. Through building up parts using different materials and techniques, students will learn about novel manufacturing methods while working to achieve goals with their built parts.

Alex Gourley is a second year PhD student in mechanical engineering working on additive manufacturing at CMU. He was born and raised in Iredell County, North Carolina. Alex went to Duke University and double majored in mechanical engineering and chemistry. While at Duke he played on the football team as a center for the offensive line. He was a member of the Duke Motorsports team and worked one summer for a NASCAR team. Outside of his studies, Alex enjoys playing video games, music, and woodworking.



Dr. Matthew O'Toole

CAMERAS AND DISPLAYS GRADES 5-7

October 15th

Building your own cameras and displays is not just fun, but good engineering practice. This workshop will have three parts. First, we will go over the history of imaging, basics of optics and photography, and operating principles behind a modern digital camera. Second, we will convert your cellphone into a microscope and use it to magnify tiny objects and explore interesting subjects. Third, we will understand how we see in 3D and build a 3D display, the opposite of a camera.

Dr. Matthew O'Toole is an Assistant Professor with the Robotics Institute and Computer Science Department at CMU. Before moving to Pittsburgh, he received a Ph.D. from the University of Toronto and completed a postdoctoral fellowship at Stanford University. His research interest is in computational photography, a topic that lies at the intersection computer graphics and computer vision. He is also a member of the CMU Computational Imaging group (<https://imaging.cs.cmu.edu/>), whose research goal is to develop the next generation of camera and display technologies.



Dr. Joanne Beckwith

COMPLEX FLUID TOYS GRADES 5-7

November 5th

Is slime a liquid or a solid? What about a gummy worm? In this workshop we will explore the world of complex fluids, which are materials that aren't quite solids, but aren't quite liquids either! We'll learn all about the chemistry that makes these types of materials squishy and gooey, along with how chemical engineers use these materials to make products we use every day, including toys like silly putty and bouncy balls.

Dr. Joanne Beckwith is an assistant teaching professor in the Department of Chemical Engineering at Carnegie Mellon University. She earned her Ph.D. from the University of Michigan where she studied bacterial and fungal biofilms which are a common cause of medical device infections. She also worked as a manufacturing engineer at a company that makes paint pigment. Currently, she teaches Intro to Chemical Engineering, and the Chemical Engineering Lab courses. She is passionate about helping students understand the impact of chemical engineering has on our everyday lives and the wide range of job opportunities a degree in chemical engineering offers. When she is not teaching, you can find her going for a run or rock climbing.



Harrison Lawson

Harrison Lawson is a third year Chemical engineering doctoral student at Carnegie Mellon University. He conducts research in Professor Si-Yang Zheng's Biomedical Engineering Lab, where he focuses on designing novel nanoparticle formulations for delivering nucleic acid therapeutics. Harrison hopes his research will lead to new vaccine formulations and therapies for rare genetic diseases. He received his B.S. in Chemical Engineering at the University of Pittsburgh in 2018 and his M.S. in Chemical Engineering at Michigan State University in 2020. When he's not working, Harrison enjoys listening to music, cooking, and going to trivia nights with his friends.



Megan Walsh

Megan Walsh is a second year PhD student in the Chemical Engineering department at Carnegie Mellon. She enjoys exploring chemical engineering problems through a math and coding lenses. Specifically, she works on computational research aimed at optimizing large-scale pharmaceutical production processes. Before coming to CMU, Megan attended the University of Connecticut to study chemical engineering and graduated with a B.S. in 2021. Outside of school, Megan enjoys hiking, baking, and playing the flute.



Students participating in hands-on STEM activities in Gelfand Outreach workshops.



Dr. Ioannis Gkioulekas

DIGITAL PHOTOGRAPHY GRADES 7-9

September 24th

This class provides a first introduction to photography, optics, and imaging. We will begin by investigating properties of optical elements such as lenses, prisms, and filters, and see how we can use them to manipulate light. Then, we will go over how digital image sensors work, and take a look at the internals of a digital camera. We will use this background to understand the various settings (focus, zoom, exposure) and stages (optical, analog, digital) of the modern photography pipeline. In parallel, we will get hands-on experience with all these concepts using high-end digital cameras, including a photography competition at the end.

Dr. Ioannis Gkioulekas is an assistant professor at the Robotics Institute of Carnegie Mellon University, where he has been since 2017. Before that, he was a PhD student at Harvard University, and even before that an undergraduate student at the National Technical University of Athens, Greece. He works on computational imaging, which can be broadly described as coming up with systems that combine imaging (optics, sensors, illumination) and computation (physics-based modeling and rendering, inverse algorithms, learning) in innovative, unexpected, and meaningful ways. He is also more broadly interested in computer vision and computer graphics. He has received the Best Paper Award at CVPR 2019, the NSF CAREER Award, and the Sloan Research Fellowship.



Dr. Adithya Pediredla

Dr. Adithya Pediredla is a project scientist at Carnegie Mellon University. His research interests span computational imaging and physics-based rendering, and their combined use for imaging with multiply-scattered light. He received his PhD in 2019 from Rice University, where his thesis received the Ralph Budd best engineering thesis award. He received his Master's degree from the Indian Institute of Science, where he received the Prof. K. R. Kambati memorial gold medal, and an innovative student project award from the Indian National Academy of Engineering. He completed his undergraduate studies at the National Institute of Technology, Warangal, India, where he received Institute and N. Ramarao memorial gold medals for academic excellence. Adithya Pediredla is joining Dartmouth College as a tenure-track assistant professor starting January 2023.



Dr. Amber LaPeruta

DNA EXTRACTION GRADES 5-7

September 24th

You may have heard of DNA, but have you ever wondered what DNA looks like and what its job is? In this lab, you will learn about the structure and function of DNA. You will then explore how and where DNA is stored in plant and animal cells using a microscope. Then, you will break apart the cell membrane of a strawberry and extract its DNA. You will get to see, touch, and take home actual DNA.

Dr. Amber LaPeruta has been a part-time lecturer at CMU since 2021. She earned her PhD from Carnegie Mellon University in Molecular Biology and Genetics and her B.S. in Biological Sciences from Stevenson University where she minored in Mathematics and Chemistry. She has been teaching Evolution at CMU and introductory laboratory classes at Pitt which allow students to learn basic biology lab techniques while contributing to authentic research projects.



Zefang Li

ENGINEERING MATERIALS FOR SOFT ROBOTICS GRADES 7-9

October 15th

In this hands-on lesson, you will learn about the rapidly developing field of soft robotics and how advances in materials are enabling new and exciting capabilities in robotics, wearables, and human-computer interaction. Discover how embodied intelligence in specialized materials can be harnessed to perform useful functions and how these materials offer new ways for us to interact with technology. Then put this knowledge to use by designing your own heat-activated soft robots!



Michael Vinciguerra

Zefang Li is a second year Master's student in the Mechanical Engineering Department at Carnegie Mellon University. He received his B.S. in Mechanical Engineering from Shanghai Jiao Tong University, China (2021). He is working in the Soft Machines Lab at CMU advised by Prof. Carmel Majidi. His research interests are in developing liquid crystal elastomer actuators for soft robotics and human-computer interaction.



Anthony Wertz

Michael Vinciguerra is a PhD student co-advised by Dr. Carmel Majidi (Mechanical Engineering) and Dr. Lining Yao (Human Computer Interaction Institute). Prior to joining CMU, Michael completed his undergraduate university in Mechanical Engineering and Computer Science at Rutgers University in New Jersey. His current work focuses on processing, liquid crystal elastomer, a novel soft material that behaves like artificial muscle, through 3D printing techniques.

Anthony Wertz is a third year PhD student in robotics in the Soft Machines Lab at Carnegie Mellon University. A computer engineer by training (BS, MS), he has extensive industry experience in embedded systems, software development, and applied machine learning. Modeling, control, and hardware realization of advanced material systems in soft robotics are at the heart of his research.



Dr. Xu Zhang

FROM SAND TO SILICON: THE MAKING OF INTELLIGENCE GRADES 6-8

October 15th

From smart phones, computers to autonomous driving cars and AI robots, their most extraordinary functionalities largely rely on one magic material – silicon. Such a magic material is, however, made from sand – one of the most common materials on earth! How this becomes possible and where the future is heading for? This workshop will answer these questions. We will present the making of microchips – the brains of almost all electronics. You will also have the opportunity to see the next magic material that might replace silicon in future electronics!

Dr. Xu Zhang joined the Department of Electrical and Computer Engineering (ECE) at Carnegie Mellon University (CMU) as a tenure-track assistant professor in September 2019. He received his PhD and Master's degrees in electrical engineering from Massachusetts Institute of Technology (MIT) and a bachelor's degree in physics from University of Science and Technology of China (USTC). Before joining CMU, he worked as an Argonne Scholar at Argonne National Laboratory from 2018 to 2019. His research lab at CMU focuses on the development of next generation semiconductors, especially atom-precise 2D materials, to enable new paradigms of electronic and photonic devices and their system-level integration. Xu Zhang is a recipient of the MIT Technology Review 35 Innovators Under 35 (2022), Enrico Fermi Fellow (2018) and MIT Global Fellow (2014).



Dr. Sneha Narra

MADE BY ME! GRADES 3-5

October 15th

In this workshop, students will use 3D pens and the polymer printers to make small fun parts that they can take home. We will use laser scanners to scan small parts that will then be printed for the students. We will discuss exciting engineering applications using videos showing manufacturing of rocket parts, ship components, other equipment parts, and demo parts in the additive manufacturing lab on campus. The concepts will emphasize the material we can save, how quickly we can make parts, and how it will impact society. Let's get printing!

Dr. Sneha Narra received a Master of Science in computational mechanics, and a Master of Science and doctorate in mechanical engineering from Carnegie Mellon University (CMU). After receiving her doctorate, she worked as a postdoctoral research associate at the Next Manufacturing Center at CMU. She then served as an assistant professor in the materials and manufacturing program at Worcester Polytechnic Institute, before joining CMU as an assistant professor in fall of 2021. Dr. Narra's additive manufacturing process design research lies at the intersection of process modeling including numerical, analytical, and semi-analytical methods, processing experiments, materials characterization, and data-driven analysis. As an instructor, Narra's goal is to help her students learn effectively in a comfortable environment and spark interest in them to explore outside the classroom. To meet this goal, she adopts a teaching philosophy that builds on creating an inclusive learning environment, active participation from students, learning through real-world examples and demonstrations, and assessment techniques optimized for long-term retention and exploration. Outside the classroom, Narra is passionate about mentoring women in engineering. Specifically, she participates in outreach activities, educates students about professional development opportunities, and provides opportunities to conduct research in interdisciplinary topics.



Dr. Gizelle Sherwood

MARVELOUS MACROMOLECULES GRADES 3-5

September 24th

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 Associate 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 Modern Chemistry, the sophomore year Analytical Chemistry labs as well as a Cosmetic Chemistry course. She is passionate about engaging students in discussion of the application of Chemistry to everyday life and has been involved in several outreach programs working with both the Boy Scouts of America and the Leonard Gelfand Center.



Rebekah Adams

NANOENGINEERING WITH DNA GRADES 3-5

September 24th

This course introduces the structure of DNA and the complementarity of its nucleobases and builds to the eventual design of super molecular nanostructures called DNA origami. Students will utilize simple household items including pasta and pipe cleaners to construct complementary single stranded DNA that they hybridize for DNA duplexes. Students next apply that knowledge as they use a custom system designed by the Taylor Lab at CMU to design and construct their own unique DNA origami.

Rebekah Adams is a PhD student in the Mechanical Engineering Department at Carnegie Mellon. She was born and raised in South Orange, NJ. She acquired her undergraduate degree in Chemical and Biological Engineering from Princeton. Her research focuses on fabricating DNA origami structures for immunomodulation and biosensing applications. Paying it forward, she is passionate about academic service and community building, especially for those with underprivileged backgrounds, via science, mathematics, and engineering. Rebekah previously tutored and mentored K-12 students since 2014. Outside of her studies, she enjoys reading, journaling, playing violin and piano, kick boxing and drawing.



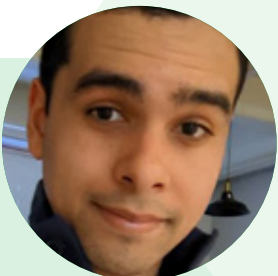
Dr. Oliver Kroemer

PERCEIVING THE WORLD THROUGH ROBOT SENSORS GRADES 4-6

November 5th

Which household chore would you like a robot to do for you? What does the robot need to know about its surroundings to perform that chore? We will explore different sensors and discover the various types of information that they provide. Learn about how robot sensors mimic human sensing capabilities and sometimes exceed them! Build a sensor-actuator loop that reacts to its environment. Learn how machine learning is making it easier for robots to perceive the world around them.

Dr. Oliver Kroemer is an assistant professor at the CMU Robotics Institute. His research interests are in machine learning and robotics, with a focus on learning for grasping and manipulation. Before joining CMU, Oliver was a postdoctoral researcher at the University of Southern California. He received his Masters and Bachelor's degrees in engineering from the University of Cambridge in 2008, and he defended his PhD thesis at the Technische Universitaet Darmstadt in 2014.



Richard Desatnik

SOFT ROBOTICS GRADES 6-8

November 5th

Soft Robotics is the study of robots made from non-rigid flexible links. These systems are increasingly being incorporated into the industry as their flexible nature increases safety and versatility. Soft robots are also an excellent analog for studying soft aquatic animals such as brittle stars, jellyfish, and more. This workshop will teach students how to create their own soft limbs with shape memory alloys (SMA). As well as cover how the field of soft robotics is used in research and society today.

Richard Desatnik is a graduate student in mechanical engineering at CMU. When receiving his undergraduate degree in mechanical engineering from the University of Akron, he worked on artificial intelligence research for Akron Children's Hospital. His graduate research focuses on soft robotic systems for biomimetic applications. Richard is also a cyberwarfare commander for the Ohio Army National Guard and a graduate of the Army Airborne School. Richard has a spirited interest in teaching students about opportunities in STEM through fun and engaging projects. He believes teaching the students of today will lead to the advancements of tomorrow.



Dr. Linda Peteanu

SCIENCE BEHIND SOLVING THE ENERGY 'CRISIS'

GRADES 7-9

November 5th

The goal of this class is to explore how researchers are using basic physical principles in light and optics combined with the creative design of molecular structures to develop efficient solar energy modules and energy efficient lighting to lessen our dependence on fossil fuels. We will introduce some basic physics and chemistry principles to explain how these devices interconvert light and electricity and explore both the promise and some of the current challenges to the development of these key technologies.

Professor Linda Peteanu has been a teacher and researcher in the Department of Chemistry at Carnegie Mellon University for almost 30 years. She has taught several laboratory and lecture courses in physical and analytical chemistry and has hosted numerous undergraduate researchers in her laboratory. In her research she uses microscopy-based techniques to characterize molecules used in photovoltaics and light emitting diodes. She has been actively engaged in science outreach to K-12 students and to the general public through the Phipps Conservatory "Meet a Scientist" program. She is passionate about engaging students in science and research projects at a young age.



*Students learn about soft robotics and prepare to create their own silicone digits (Above Left).
Students examine small air particles to learn about smog and clouds (Above Right).*



Dr. Gloria Silva

TINY HARD WORKING GUYS GRADES K-2

October 15th

This workshop will show the students how microscopic organisms can do a fantastic and effective job transforming certain chemical compounds into gases among other things. We will use the Baker's yeast to produce CO₂ and O₂. 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 that 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 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.



Above, students create hydrophobic art (left) and conduct an experiment in the chemistry lab at Mellon Institute (right).

Gelfand Outreach Fall 2022 Saturday Series Classes

Classes are \$55.00 each and are conducted from 9:00AM to noon unless otherwise noted,
at Carnegie Mellon University.*

NOTE: Strict COVID-19 mitigation requirements will be in place; we will be following CMU protocols which may include mandatory vaccination, wearing masks, and/or social distancing depending on recommended guidelines at the time of the class. There is NO eating or drinking allowed in classrooms during Gelfand Outreach programs.

Please contact the GelfandCenter@andrew.cmu.edu for Gelfand Outreach registration questions.

September 24th

*Gr. K-2: Bug Bots
Gr. 3-5: Marvelous Macromolecules
Gr. 3-5: Nanoengineering with DNA
Gr. 5-7: DNA Extraction
Gr. 5-7: Build an Autonomous Rover
Gr. 7-9: Digital Photography*

November 5th

*Gr. K-2: Bug Bots
Gr. 3-5: Building Blocks of 3D Printing
Gr. 4-6: Perceiving the World Through Robot Sensors
Gr. 5-7: Complex Fluid Toys'
Gr. 6-8: Soft Robotics
Gr. 7-9: Science Behind Solving the Energy 'Crisis'*

October 15th

*Gr. K-2: Tiny Hard Working Guys
Gr. 3-5: Made by Me!
Gr. 4-6: Batteries! Get Wired!
Gr. 5-7: Cameras and Displays
Gr. 6-8: From Sand to Silicon: The Making
of Intelligence
Gr. 7-9: Engineering Materials for Soft Robotics*

To apply for scholarship funds, please submit a copy of the first page of your IRS 1040 tax form from 2021.

Thank you to alumnus Bernard N. Meisner S '71 for providing scholarship funds to support students in Gelfand Outreach classes.