

Carnegie Mellon University

Leonard Gelfand Center



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

Spring Saturday 2024 Series Classes - Carnegie Mellon University

Each class is \$55. Scholarship funds are available through gifts from several Carnegie Mellon alumni. Please see the information on page 9.

ACIDITY IN YOUR ENVIRONMENT, Grades 4-6, April 20th

Acids are produced by air pollution and go on to have large effects on our environment, climate, and health. You will learn how to measure the acidity of different samples using a variety of colorful methods. Then we will explore how acidity controls important processes and chemical reactions occurring all around us.



Dr. Ryan Sullivan is a professor in the Departments of Chemistry and Mechanical Engineering at Carnegie Mellon University. He is also a faculty member in the Center for Atmospheric Particle Studies. Sullivan has a background in atmospheric and analytical chemistry, single-particle analysis, heterogeneous kinetics, and cloud nucleation research. His research interests include the development of improved aircraft-deployable analytical instrumentation to characterize individual particles in the atmosphere in real-time. These instruments are used to investigate the physicochemical properties of atmospheric particles emitted and produced from a variety of sources, the chemical processes they experience during atmospheric transport, and how these processes modify the ability of particles to nucleate both cloud droplets and ice crystals, thus altering cloud properties and the Earth's climate. These research endeavors involve equal parts instrument development, laboratory experiments, and field measurements.

BLOOD TYPING, DISEASES AND DIAGNOSIS, Grades 5-8, February 17th at the Mellon Institute

Blood typing is of critical importance, especially if a transfusion is needed. In this project, we will explore blood and blood typing through a variety of techniques. Using synthetic blood, students will learn about how blood interacts with the body and how blood typing occurs. Students will conduct an experiment using antibodies to identify blood type followed by examination with slides of blood smears. This will ultimately let students identify the needed blood type for a mock transfusion.



Dr. Lynley Doonan joined the Department of Biological Sciences at Carnegie Mellon University as Special Faculty in 2018. She earned her Ph.D. at the University of Pittsburgh in Molecular, Cell, and Developmental Biological Sciences with a teaching minor and her B.S. in Biological Sciences at Carnegie Mellon University. She has been teaching introductory laboratory classes to expose students to a variety of basic biology laboratory techniques.

5000 Forbes Avenue, Cyert Hall A64, Pittsburgh, PA 15213 - 412-268-1863

<http://www.cmu.edu/gelfand> - GelfandCenter@andrew.cmu.edu

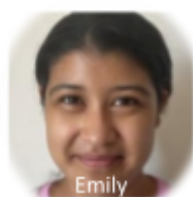
BRAIN-BOTS, Grades 7-9, April 20th

How does the brain work to control your body? In this workshop you will have the opportunity to learn about the inner workings of the brain. We will discuss how our brains use electrical impulses to generate our thoughts and actions, with a focus on how the brain controls our muscles and produces vision. The electrical signals the brain uses to control your body can even be used to control a robot! There will be hands-on demonstrations to explore your awesome brain in action.



Megan McDonnell, Kendra Noneman, Emily Lopez, and Eve Ayar

Megan, Emily, Kendra, and Eve are all Ph.D. students at Carnegie Mellon's Neuroscience Institute. As scientists, they research how the brain works to control the body and senses, with specialties in vision and brain-computer interfaces. As part of the neuroscience programs at Carnegie Mellon, they serve as teaching assistants, as well as being involved in science-related outreach programs. One of their shared passions is bringing accessible science to kids, and inspiring more young minds to join STEM fields like neuroscience.



BUG-BOTS, GRADES K-2, April 20th

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.

Reed Luttmner is a third-year student at Carnegie Mellon University, majoring in Mathematical Sciences. They are a head teaching assistant within CMU's School of Computer Science, a research assistant for CMU's Infant Cognition Lab, and the community development chair of the CMU Math Club. Reed has worked in a variety of childcare settings, including as a tutor, quiz bowl coach, ski instructor, and most recently, a supervisor at an overnight camp for children with social, emotional, and behavioral challenges. In their free time, Reed enjoys reading, going for walks, playing quidditch, and spending time with their friends and family. Reed is passionate about sharing their love of STEM with others, and they are excited for this to be their third year working with the Leonard Gelfand Center.



BUILDING BLOCKS OF 3D PRINTING, Grades 3-5, April 20th

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 Ph.D. 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.

BUILDING WITH STICKS AND STRAWS, Grades K-2, *January 27th OR April 20th*

Let your creative juices flow and build with items found around your house. We will discuss structures and shapes and then you will design your own structures. You will build a variety of structures using cardboard, pipe cleaners, bamboo skewers, toothpicks, tape, and straws. Caution, construction ahead!



Kathie Stilinovich spent her childhood living in Brussels, Belgium and living up and down the California coast. She graduated from Pacific Oaks College in Pasadena with a Bachelor of Arts in Early Childhood Education and Development. She has over 30 years of experience working in the field as a teacher. She is the educational support staff for CMU's Children's School. Before moving to Pittsburgh, Kathie and her family lived in Boise, Idaho. They loved the small city to raise their two daughters. Once their girls left to pursue their dreams in other cities, Kathie and her husband decided they needed a new adventure on the other coast. They love Pittsburgh and all it has to offer. Kathie and her husband love to bike ride, walk their dogs, get coffee, and explore Pittsburgh.

CHEMISTRY OF SHAMPOO, Grades 4-5, *February 17th at the Mellon Institute*

With all the hair products on the market, do you ever wonder what makes a good shampoo? Does your shampoo work the best? What does "work the best" mean? In this lab, you will test shampoos by testing the pH, determining the percent of solids, flash foam formation, foam retention, relative viscosity, India ink dispersion, and the cost of the shampoo. After you have completed each of the tests, we will graph and compare the data on all three shampoos, and as a class, determine which shampoo works best on your hair. You may bring your own shampoo to test, and there will also be shampoo samples in the lab to test.



Dr. Carrie Doonan is the Director of Undergraduate Laboratories and a Teaching Professor in the Department of Biological Sciences at Carnegie Mellon University. She was educated at Chatham College (BS) and the University of Connecticut (Ph.D.) and began her teaching career at Carnegie Mellon University in 1993. Her primary area of focus involves the teaching and administration of a range of experimental laboratories in the department. She is responsible for writing and developing experimental units, training of junior faculty and teaching assistants, and is actively involved in all aspects of the undergraduate program. Dr. Doonan has adapted many of her curricular innovations for use in K-12 outreach and has been invited to present this work at regional and national forums. She served as a Biotechnology Institute National Biotechnology Teacher-Leader in 2003 and 2005 and was awarded the Julius Ashkin Teaching Award in the Mellon College of Science in 2000. She was also awarded the Mark Gelfand Award for Service Learning and Outreach in 2011, and the Richard Moore Award in 2022.

CODING FOR BEGINNERS, Grades 2-4, *January 27th*

Have you ever wondered how computers make decisions? In this course, we will learn how computers follow routines and instructions to complete a final task. Coding can seem like a lot of complicated numbers, so we will teach through fun activities where students perform everyday tasks to simulate how a computer 'thinks.' Kids will act as both a person instructing a computer and as the computer interpreting its instructions. The purpose of this course is to introduce coding concepts with off-line instructional activities.



Elsa Schleicher is a senior at CMU studying Mechanical Engineering. She has previous experience as a Science Olympiad team coach for middle school students and has been a volunteer CAD/mechanical instructor for an upcoming FTC robotics team. In her free time, she enjoys reading, painting, and martial arts.

COMPLEX FLUID TOYS, Grades 4-6, *March 23rd*

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 Maddock 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 that chemical engineering has on their 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.



Megan Walsh is a second-year Ph.D. student in the Chemical Engineering department at Carnegie Mellon. She enjoys exploring chemical engineering problems through math and coding lenses. Specifically, she works on computational research aimed at optimizing largescale 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.

DIGITAL PHOTOGRAPHY, Grades 6-9, *March 23rd*

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.

DNA AND EVOLUTION, Grades 4-6, *February 17th at the Mellon Institute*

You may have heard of DNA, but have you ever wondered what DNA looks like and what its job is? DNA is what makes you you, a strawberry a strawberry, and is what made a T-rex a T-rex. We will explore how DNA functions and changes by mutation, and how DNA mutations cause animals on the Earth to evolve and change. In this activity, you will get to break apart the cell membrane of a strawberry and extract its DNA. You will get to see, touch, and take home actual DNA. You will get to see and touch diverse types of live animals and put together a tree to show how they are related to one another, like a family tree. Finally, you will be able to play games to explore how evolution happens by a process called natural selection.



Dr. Amber LaPeruta is a special lecturer at CMU where she teaches Evolution and introductory laboratory classes. She earned her Ph.D. 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.

HOMEMADE COSMETICS, Grades 3-5, *March 23rd*

The skin is the largest organ in the human body. It serves to protect us from environmental stresses and hazards. As such it is important that we understand this organ and how to protect and care for it. In this workshop, students will create homemade skincare products from lotions and lip gloss to bath scrubs. This hands-on workshop will have students working in the lab and participating in lecture demonstrations to create their own formulation of a variety of over-the-counter homemade cosmetic products.



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 MEHPPV 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.

HOW ENGINEERS MAKE PLANES FLY, Grades 3-5, *January 27th*

Discover how planes fly and how engineers use Computational Fluid Dynamics (CFD) in plane design. Design your own wing and then test it in a “wind tunnel”. What shape will produce the best wing? What shapes produce no lift? Fly in to find the answers to these questions and more!



Craig Weeks is a PhD student in mechanical engineering working on computational fluid dynamics modeling of metal additive manufacturing processes. He is from Portland, Oregon and completed his undergraduate studies at Oregon State University, where he majored in mechanical engineering with a double minor in aerospace engineering and computer science. Craig was part of the hybrid and liquid-engine rocket teams at Oregon State, and interned at the NASA Glenn Research Center in Cleveland, OH working on electric aviation. In his free time, Craig enjoys trail running, playing piano and guitar, and discovering hikes in and around Pittsburgh.

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Normal liquids can do crazy things when you look at them in the right way. Did you ever think you could watch them crawl on top of or below other liquids? This class is an introduction to the chemical and physical properties of different liquids and will allow you to apply critical thinking skills and the scientific method to make observations about liquids. Learn about physical properties such as density, viscosity, cohesion, and adhesion by observing the behavior of different liquids. You've never seen liquids this crazy!



Teddi Bishop is a third-year student at Carnegie Mellon University, double majoring in chemical and biomedical engineering. Teddi works for the Leonard Gelfand Center as a teaching assistant and an office member where she organizes and prepares the classes. She also conducts research in a laboratory at the University of Pittsburgh where she works with PDMS microfluidic devices and breast cancer cell spheroids to study the interactions between T-cells and cancer cells. During the summer of 2023, Teddi worked as a research and development engineering intern for Procter and Gamble. In the future, she plans on pursuing a fifth-year master's degree in Biotechnology and Pharmaceutical Engineering.

MATH TURNED INSIDE-OUT, Grades 5-7, January 27th

In this workshop students will be introduced to the basic ideas of topology, a field of mathematics that is becoming increasingly crucial to physics and engineering. It is the study of how spaces are organized and how they are structured and whether they can be smoothly deformed into each other or not. Through hands-on exercises, students will construct topologically inequivalent objects, like cylinders and moebius strips and examine them to discover and understand their difference.



Dr. Shubhayu Chatterjee joined the Department of Physics at Carnegie Mellon University as an Assistant Professor in January 2023. His research focuses on emergent phenomena in condensed matter physics and tries to understand novel behavior which results from the sheer scale and complexity of billions of interacting particles in everyday materials. He also studies how to use tools from the quantum information community to sense such emergent phenomena. Prior to joining CMU, he was a postdoctoral fellow at UC Berkeley. He received his PhD in Physics from Harvard University, and holds an integrated Masters in Physics from the Indian Institute of Technology Kanpur.

MICROSCOPIC WORLD OF CELLS, Grades 2-4, February 17th at the Mellon Institute

What do a person, an onion, and bacteria all have in common? All of these, and all living organisms, are made of cells. Most cells are too small to see by eye, but in this workshop you will use microscopes to explore what cells from organisms including plants, yeast, and bacteria look like when you get really, really close. You will learn how microscopes work, and how scientists use them for research. You will practice using microscopes to guess the identity of microscopy mystery samples. Then you will be the scientist, preparing samples on microscope slides to test hypotheses about what happens to cells when you change their environment.



Dr. Emily Drill is an Assistant Teaching Professor in Biological Sciences at CMU. She has been teaching laboratory courses at CMU since 2012 in a variety of topics including genetics, cell biology, developmental biology, and neuroscience. She teaches high school students through summer programs including the Pennsylvania Governor's School for the Sciences; recent projects include using CRISPR technology in yeast and testing how the environment affects neuron function in worms. She holds a Ph.D. in Neuroscience from the University of Pittsburgh and a B.S. from CMU.

PERCEIVING THE WORLD THROUGH ROBOT SENSORS, Grades 4-6, March 23rd

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 Master's and Bachelor's degrees in engineering from the University of Cambridge in 2008, and he defended his Ph.D. thesis at the Technische Universität Darmstadt in 2014.

SCALING AND SIMILITUDE, Grades 7-9, *January 27th*

Why is a 10-inch pizza typically more than double the price of a 6-inch pizza? Why are humans around 5 feet tall, but never 50 feet tall? (And why are blue whales "only" 100 feet long, but never 1000?) Why can a small amount of arterial buildup lead to a large amount of trouble? Why do elephants have such huge ears? Why are I-beams so widely used in construction projects? Why do dogs pant? What do the answers to these questions imply about building a society with meaningful interpersonal relationships? And last (but not least of all), how the heck do you get the last bit of toothpaste out of the tube? In this class, we will share a simple mathematical framework -- scaling and similitude -- that can be used to answer all these questions (at least partially... some are quite tough!). This framework helps enormously with high school homework, and it can single-handedly power you through a PhD. It is easy enough to grasp in an hour, yet so challenging that it takes a lifetime to master. Join this class and start the journey of a lifetime!



Dr. Jerry Wang is an Assistant Professor of Civil and Environmental Engineering, and Chemical Engineering (by courtesy) and Mechanical Engineering (by courtesy), at Carnegie Mellon University. He received his BS in 2013 from Yale University (Mechanical Engineering, Mathematics and Physics), SM in 2015 from MIT (Mechanical Engineering), and PhD in 2019 from MIT (Mechanical Engineering and Computation). He performed postdoctoral research at MIT in chemical Engineering. He was a member of the inaugural cohort of the Provost's Inclusive Teaching Fellowship at CMU, was the 2020 recipient of the Frederick A. Howes Scholar Award in Computational Science and the 2016 MIT Graduate Teaching Award in the School of Engineering, and is an alumnus of the Department of Energy Computational Science Graduate Fellowship and the Tau Beta Pi Graduate Fellowship. Wang directs the Mechanics of Materials via Molecular and Multiscale Methods Laboratory (M5 Lab) at CMU.

STOCK MARKET, Grades 4-6, *January 27th*

What are stocks? How do people make decisions about buying stocks? See what it's like to be a stock trader by participating in a stock market simulation. Buy stocks, pay commissions, and trade stocks with your friends. We have a challenge for you: can you invest some "money" and turn it into a whole lot more? Play our game and find out!



Dr. Carla Bevins is an Assistant Teaching Professor of Business Communications in the Tepper School of Business at Carnegie Mellon University (CMU). Dr. Bevins taught in the School of Information Sciences at the University of Kentucky (UK) and as a Visiting Educational Scholar at Qingdao Technological University. She earned her B.A. in English and Creative Writing with a concentration in Public Relations from Butler University and her Ph.D. in Communications from UK. She holds Graduate Certificates from the UK in Health Communications, Medical Behavioral Sciences, Statistics, and Distance Education. At CMU, Dr. Bevins mentors undergraduate and MBA students and teaches Business Communications, Business Presentations, and Interpersonal Managerial Communication.

USING DNA FINGERPRINTING IN FORENSICS, Grades 6-8, *February 17th at the Mellon Institute*

DNA fingerprinting allows forensic scientists to compare crime scene DNA to suspect DNA in a case. In this project, we will learn about how differences in our DNA can be used like a "fingerprint" to identify individuals. DNA can be obtained from a single hair left behind at a crime scene. We will work with DNA isolated from hair from a mock crime scene and compare it to mock suspect DNA. We will learn essential lab skills like micropipette and use techniques that real forensic scientists use to solve our mock case.



Dr. Brett Wisniewski is Special Faculty at Carnegie Mellon University where he teaches biology lecture and lab courses. He studied at Northwestern University for his PhD and Marquette University for his BS. He has always strived to make biology education accessible to individuals from all backgrounds.

GELFAND OUTREACH

Spring Saturday 2024 Series Classes - Carnegie Mellon University

Classes are \$55.00 each and are conducted from 9:00 AM to Noon on the Carnegie Mellon University campus.*

**To apply for scholarship funds, please submit a copy of the first page of your IRS 1040 tax form from 2022.*

January 27th

Gr. K-2: Building with Sticks and Straws
Gr. 2-4: Coding for Beginners
Gr. 3-5: How Engineers Make Planes Fly
Gr. 4-6: Stock Market
Gr. 5-7: Math Turned Inside Out
Gr. 7-9: Scaling and Similitude

February 17th

Gr. 2-4: Microscopic World of Cells*
Gr. 4-5: Chemistry of Shampoo*
Gr. 4-6: DNA and Evolution*
Gr. 5-8: Blood Typing, Diseases, and Diagnoses*
Gr. 6-8: Using DNA Fingerprinting in Forensics*

*These classes take place at the Mellon Institute

March 23rd

Gr. K-2: Liquid Science
Gr. 3-5: Homemade Cosmetics
Gr. 4-6: Robot Sensors
Gr. 4-6: Complex Fluid Toys
Gr. 6-9: Digital Photography
Gr. 7-9: Imaging and Single Photons

April 20th

Gr. K-2: Building with Sticks and Straws
Gr. K-2: Bug Bots
Gr. 3-5: Building Blocks of 3D Printing
Gr. 4-6: Acidity in Your Environment
Gr. 7-9: Brain Bots
Gr. 8-9: Learn Engineering Using Minecraft

Students in Dr. Sherwood's Doherty Hall Lab



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Fun!

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