

# STEM\*

Education Planning Guide 2016-17

\*STEM= Science, Technology, Engineering, and Mathematics





# Welcome to the Liberty Science Center

# STEM

## Education Planning Guide

Liberty Science Center, in partnership with the New Jersey Department of Education, was a lead partner of the 26-state team that provided leadership during the development of the core components of the Next Generation Science Standards. The Next Generation Science Standards form the basis of the **New Jersey Student Learning Standards for Science (NJSL-S)**. As school districts in New Jersey begin the transition to the NJSL-S, Liberty Science Center is prepared to provide leadership to your teachers in methods of unpacking the NGSS in classroom science curriculum and to guide your students in building proficiency towards mastering the NGSS Performance Expectations.

Two new exciting lab spaces are available to students this year. In the **Innovation Lab** students can learn the fundamentals of software coding, develop mobile apps and explore geographic information system (GIS) software. The **MakerLab** allows students to gain proficiency with 3D printers, develop electronic projects with Arduino, and construct solutions to engineering design challenges. There is a 1:1 student to 3D printer ratio so that every student can explore all aspects of 3D printing. Engineering design is a major component of all grade levels in NGSS with performance expectations that focus on Defining Problems, Developing Solutions, and Improving Designs.

The award winning **Live From Surgery** program expands to New York State this year with the addition of Columbia University Medical Center. This program allows students to join the surgical team during real-time surgeries being performed in some of the best hospitals in New Jersey and New York. The audiovisual hardware has been updated this year to HD resolution, providing images so clear it seems as though students are in the operating room. As part of the program, students can try their hand at performing surgery using an actual da Vinci Surgical System. The da Vinci System is powered by robotic technology that allows the surgeon's hand movements to be translated into smaller, precise movements of tiny instruments inside the patient's body. An important component of the program is an exploration of careers in the medical field, which includes not only surgical staff but also support staff such as Information Technology Specialists, Website Designers, and Medical Equipment Technologists.

This guide is organized into three sections: on-site, off-site, and professional development offerings. Every program is accompanied by detailed curriculum connections to the New Jersey Student Learning Standards-Science to help you identify those programs that best meet your curriculum.

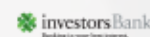
If you have an educational need for which you do not find a compatible program in this guide, please make us aware of your requirements. Our STEM education staff may be able to develop a program that more closely aligns with your student curriculum and teacher professional development needs.

Sincerely,



Patrick McQuillan  
Vice President, STEM Education

**Liberty Science Center acknowledges the generous support of Josh Weston and Jennifer Chalsty.**  
**LSC is also grateful to the following donors for their support.**









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COMING SOON: The Jennifer A. Chalsty Planetarium

LSC's programming has been revised to align with NJSLS (Science). Look for specific standards alignment below each program offering in this guide.





# Field Trips at LSC

Your school group admission includes full access to our twelve exhibition galleries and to free Live Science presentations that take place during the day. Ask about our Live Science offerings and we will try to ensure a particular presentation for the day of your trip. You can also add structured STEM-based activities including laboratory workshops, IMAX and 3D films, or a Live From Surgery program to enhance your visit.



## FIELD TRIP ENHANCEMENTS

### IMAX Dome Theater

Students can explore distant lands, travel deep into the cosmos, or investigate the animal kingdom in the world's largest IMAX Dome Theater.

### Joseph D. Williams 3D Science Theater

Catch spectacular science adventures in our 300-seat theater.

### Center Stage Science Shows

Our live group shows bring science concepts to life and include audience participation. Each show aligns with core concepts from required science curricula.

- **Flame, Foam, and Foom! Meet the Elements**  
Elements dance in flames, ignite, and react dramatically in this energetic and explosive chemical play.
- **The Weather Show**  
Thunder roars, clouds form, and tornadoes appear in this fast-paced interactive program.
- **Nikola Tesla Lightning Show**  
Twin solid-state, one-million-volt Tesla coils produce bursts of musical lightning right in front of you in our most spectacular live show.

### Live Science!

These interactive 20-25 minute presentations take place throughout the building, led by a STEM Educator with plenty of audience volunteers. Offerings vary each day, but can include:

- *SubZero: The States of Matter*
- *Blast Off!*
- *Be a Surgeon*
- *Cow Eye Dissection*
- *Your Puzzling Brain*
- *It's Electrifying*
- *Down to the Wire:  
How Electricity is Made*
- *The Power of Air*

### Hands-On Laboratory Workshops (page 10) and Live From Surgery Program (page 14)

Read on for complete information about these offerings.

## GENERAL INFORMATION

### Contact Us

201.253.1310 or [sales@LSC.org](mailto:sales@LSC.org)  
Weekdays 9:00 am – 5:00 pm  
Weekends 9:00 am – 2:00 pm

### Group Admission

Special rates are available for groups of 15 or more with advance reservations.

### Transportation and Directions

Easily accessible by bus, car, light rail, and ferry. See [LSC.org/plan-your-visit](http://LSC.org/plan-your-visit).

### Parking

Convenient, on-site parking is available. Cars are \$7, buses \$10.

### Health and Safety

We care about your safety and comfort. We have an allergy-aware dining room (reserve in advance), and offer free admission for school nurses. We have an experienced safety and security staff, a building-wide Code Adam protocol for lost children, and a basic first-aid room. LSC is ADA compliant, and located just one mile from a top-ranked hospital.

### Lunch Plans

To reserve brown-bag space or order box lunches, call 201.253.1310. You may also purchase lunches individually at Café Skylines, no reservations required.

### Accessibility

Liberty Science Center is accessible to all guests. You may request wheelchairs at the Welcome Desk. Assistive listening devices for hearing-impaired guests are available for the theaters and several other public areas.

### Special Needs Days

Liberty Science Center tailors days for students with special needs several times a year. Call 201.253.1310 for dates and details.



### SIGN UP FOR OUR FREE EDUCATOR NEWSLETTER

Receive an e-newsletter of program updates, professional development news, and special event previews. Email [sales@lsc.org](mailto:sales@lsc.org) to join.



Your students will have a blast on our four exhibition floors, with hands-on experiences for all ages and stages of learning. Our galleries bring a wide range of STEM topics to life, from the environment and earth science to health and green energy choices. Access to our general-admission exhibitions is included with your ticket. Education staff and volunteers are happy to answer questions, assist with interactives, and tell you more about what you're seeing.







# Hands-On Exhibitions

## Skyscraper! Achievement and Impact

Enter a cityscape of towers and discover what it takes to design and build the world's tallest skyscrapers. Walk on an 18-foot-high I-beam just like a construction worker, see what it's like to test a building in a wind tunnel, operate an electromagnetic crane, learn about careers in construction and architecture, and see artifacts from the World Trade Center.

## Eat and Be Eaten

Learn how creatures evolved to catch prey and avoid being captured in our live animal exhibit. Study beautiful examples of camouflage. See mammals, insects, reptiles, amphibians, birds, and fish in natural settings, and marvel at nature's complexity. Don't miss the incredibly adorable family of critically endangered cotton-top tamarins, the colony of industrious leaf-cutter ants, or the new community of naked mole rats!

## Honey Bees: Home Is Where the Hive Is

Watch a live colony of honey bees from just inches away as they go about their daily work. See bees collecting nectar and making honey, and get close enough to hear them buzz. Can you spot the queen?

## The Touch Tunnel

Take an 80-foot crawl through a pitch-black tunnel using only your sense of touch. It's one of our most popular experiences, so visit early or late in the day to avoid a wait.

## Our Hudson Home

Get acquainted with the creatures that live in the Hudson River at our Touch Tank and in our enormous aquariums, including 80-pound drum fish, terrapins, sea stars, and sea urchins. Then unload a virtual cargo ship, dredge a river channel, and try a real hands-on lab experiment.

## Wonder Why

Experiment with air in motion, make a six-foot-wide soap bubble, scramble up our fossil-studded rock climbing wall, and more.

## MYTHBUSTERS THE EXPLOSIVE EXHIBITION

## Infinity Climber

Explore this two-story climbing structure suspended 35 feet above the Center's atrium. Can you make it to the top?

## Nano Mini-Exhibition

Learn about nanoscience—the science of the super small — in this collection of hands-on exhibits.

## Infection Connection

Diagnose a patient, dodge a wet sneeze from the Big Blue Nose, and step into the lab to conduct a guided, hands-on experiment.

## Energy Quest

Drill for oil, locate uranium, discover the power in ocean waves and dams, and explore solar, geothermal, and wind energy.

## PixelPalooza from Bell Labs

Play an active, multi-user game and learn about computer vision.

## Communication

Discover how humans have exchanged ideas, from neolithic hand prints to sign language. Try a new way of speaking at Language Karaoke, see your electronic voice waves, and leave your mark on the digital Graffiti Wall.

## I Explore

Exhibits, free weekday classes, and story times exclusively for learners ages 2-5.

## Traveling Exhibitions

We host several exciting exhibitions each year that relate to topics in science and technology, and incorporate pop culture and entertainment. This school year, exhibitions will include *Bodies Revealed*; *Curious George: Let's Get Curious*; *MythBusters: The Explosive Exhibition*; and *Illusion: Nothing Is As It Seems*.

# Laboratory Workshops

Our lab workshops really set LSC apart from other field trip destinations. In our fully-equipped laboratories, students explore science topics in a way that reinforces learning through hands-on exploration and often sparks a lifelong interest in STEM fields.

**Grades:** 3-8

**Length:** 45 Minutes

**Times:** 9:30 am, 11:00 am, 12:00 pm, or 1:00 pm

**Maximum** 30 students per workshop

Must be booked in advance.

Call 201.253.1310.



## GRADES 3-5

### **NEW!** Adaptation Examination

Examine the physical and behavioral adaptations of live animals in an up-close encounter to evaluate how their anatomical structures help ensure their survival.

**NJSLS (Science):** Biological Evolution: 3-LS4-3

From Molecules to Organisms: 4-LS1-1

### **NEW!** Cow Eye Dissection

Follow light on its journey through the eye. In this very hands-on workshop, dissect a cow eye and gain a deeper understanding of how light gets from an object through the human eye. Explore how the shape of the lens bends light.

**NJSLS (Science):** Waves and their Applications: 4-PS4-2

### **NEW!** Magnetic Madness

Using sets of permanent magnets of varying shapes and unknown intensities, explore the formation of magnetic fields between them. Model magnetic fields by varying the distances and orientations of the permanent magnets.

**NJSLS (Science):** Motion and Stability: Forces and Interactions 3-PS2-3

### **NEW!** Brainstorming Around the World

In this workshop, students embark on a meteorological journey! Forecasting seasonal changes within different climate regions is a breeze with weather-sensing Arduinos. Students collect weather data and create graphical representations around the world.

**NJSLS (Science):** Earth's Systems 3-ESS2-1

### **Chemistry: Making Chains**

Have a slimy time learning, exploring, and playing with giant molecules called polymers. Learn how to identify their properties and their role in today's real world.

**NJSLS (Science):** Matter and Its Interactions 5-PS1-3, 5-PS1-4

### **Conductors and Insulators**

Explore the origin of electricity and investigate the ability of materials to conduct electricity.

**NJSLS (Science):** Motion and Stability: Forces and Interactions: 3-PS2-3  
Energy: 4-PS3-2

Matter and Its Interactions: 5-PS1-3

### **Bee-Bot Robot Challenge**

Bee-Bots are programmable robots that follow a few basic rules, called algorithms. Discover how algorithms can be used in conjunction with mathematics skills to develop a solution to a given problem.

**NJSLS (Science):** Engineering Design: 3-5-ETS1-1

### **StarLab: Celestial Navigation**

Crawl into a portable planetarium to watch the constellations come alive. Our state-of-the-art digital StarLab allows exploration of the cyclic patterns of lunar phases, solar and lunar eclipses, and the repeating seasonal patterns of constellations. As you journey through the stars, learn how different cultures interpret the night sky.

Note: This workshop can be individualized to focus on stars, constellations, distances, and/or moon phases and eclipses.

**NJSLS (Science):** Earth's Place in the Universe: 5-ESS1-1, 5-ESS1-2



## GRADES 6-8

### **NEW! Conserving the Masses**

Does the mass of elements really stay the same throughout chemical reactions? Explore chemical reactions, and construct support for conservation of mass based on your observations.

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-5

### **NEW! Green Energy**

Experiment with various renewable energy sources to find an alternate fuel source. Assemble a device to collect hydrogen power, explore wind energy, and experiment with solar energy.

**NJSLS (Science):** Engineering Design: MS-ETS1-2

### **NEW! All About Aquatics**

Explore water samples to identify plankton, discover the resources necessary for plankton species to grow and thrive, and identify how disruptions to their ecosystem can lead to shifts in their population.

**NJSLS (Science):** Ecosystems: Interactions, Energy, and Dynamics: MS-LS2-1, MS-LS2-4

### **NEW! Magnetic Motions**

Electromagnetism is one of the fundamental forces in our universe. Explore an electromagnetic motor to observe how various factors affect the magnitude of electrical and magnetic forces.

**NJSLS (Science):** Motion and Stability: Forces and Interactions: MS-PS2-3

### **Living or Not?**

Discover the characteristics of living things, investigate different types of single-celled and multicellular organisms, and make arguments, supported by evidence, to determine whether something is living or nonliving.

**NJSLS (Science):** From Molecules to Organisms: Structures and Processes: MS-LS1-1

### **Under Pressure**

Become a meteorologist and explore what makes weather flow. Learn to map and analyze atmospheric data to understand how various air masses govern our daily weather changes.

**NJSLS (Science):** Earth's Systems: MS-ESS2-5

### **It's All About Reactions**

Conduct an inquiry-based set of experiments using chemical reactions to analyze and interpret data on the properties of unknown substances.

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-2

### **Scaling the Solar System**

Create a model of our solar system to gain an understanding of its spatial scale. Work with fractions and ratios to generate an accurate physical model of the solar system.

**NJSLS (Science):** Earth's Place in the Universe: MS-ESS1-3

### **Matter of Clime**

Using digital globes, collect average monthly temperature and precipitation data from NASA's Earth Observatory data repository. Plot the data points on a climatograph and develop a model explaining factors that influenced climates observed in different regions around the globe.

**NJSLS (Science):** Earth's Systems: MS-ESS2-6

### **StarLab: Celestial Navigation**

Crawl into a portable planetarium to watch the constellations come alive. Our state-of-the-art digital StarLab allows exploration of the cyclic patterns of lunar phases, solar and lunar eclipses, and the repeating seasonal patterns of constellations. As you journey through the stars, learn how different cultures interpret the night sky.

**NJSLS (Science):** Earth's Place in the Universe: MS-ESS1-1

# Young Scientist Lab Workshops

Put discovery in the hands of your young scientists with activities that promote scientific thinking and reasoning.

**Grades:** Pre-K to 2

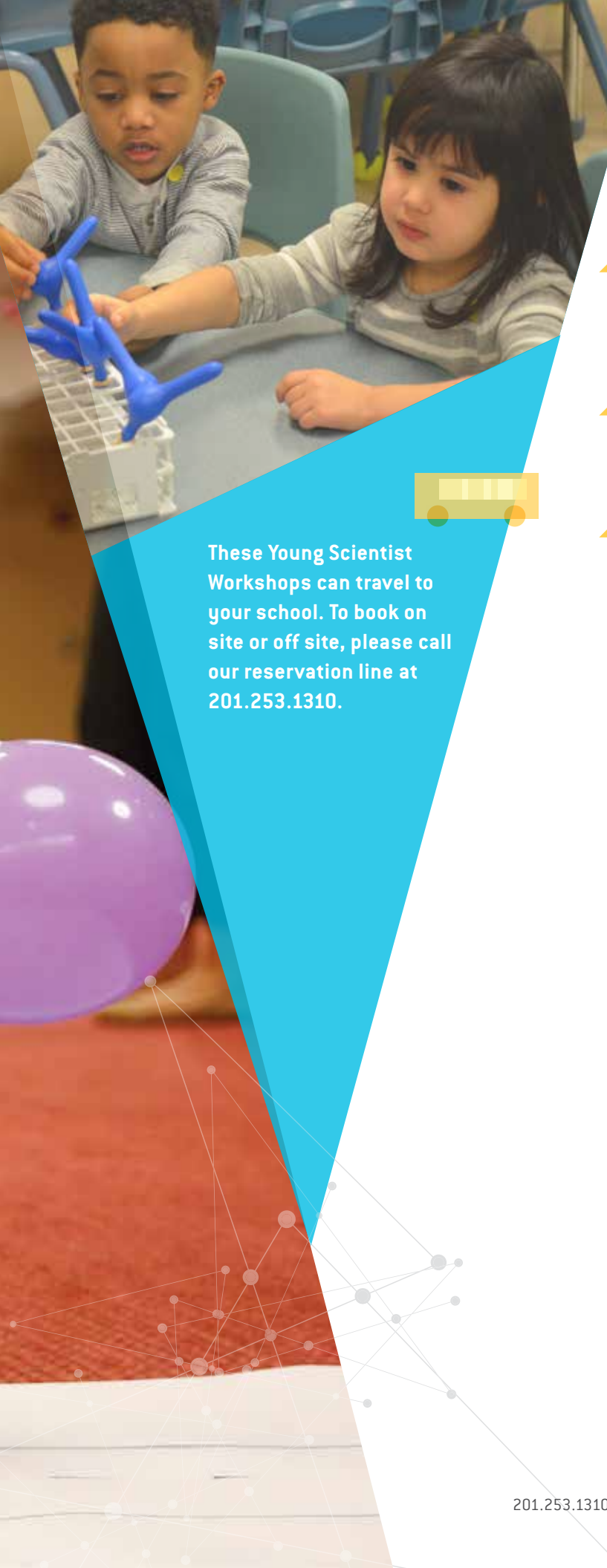
**Length:** 45 Minutes

**Times:** 9:30 am, 11:00 am

Must be booked in advance.







These Young Scientist Workshops can travel to your school. To book on site or off site, please call our reservation line at 201.253.1310.

## YOUNG LEARNERS

### **NEW! Ready, Set, Robotics!**

Aspiring computer scientists, get ready for a hands-on introduction to the world of robotics. Solve a series of challenges using mobile, responsive robots called Cubelets.

**NJSLS (Science):** Engineering Design: K-2-ETS1-1, K-2-ETS1-3

### **NEW! Mr. Golden Sun**

Explore the job of a meteorologist. Learn what happens to water as Mr. Golden Sun warms up Earth's surface.

**NJSLS (Science):** Energy: K-PS3-1

### **NEW! The Wild World of Weather**

Create the tools used to measure wind, precipitation, and temperature to explore how meteorologists record the local weather. Learn to observe weather patterns over time.

**NJSLS (Science):** Earth's Systems: K-ESS2-1

### **Natural World Around Me**

Discover what plants and animals need to grow and survive in this up-close animal encounter. Observe a variety of live plants and animals, use your observations to describe patterns, and identify evidence that led to these discoveries. This workshop can be individualized to focus on, but is not limited to, the following topics: reptiles and amphibians, insects and arachnids, aquatic animals, pollinators, and invertebrates vs. vertebrates.

**NJSLS (Science):** From Molecules to Organisms: Structures and Processes: K-LS1-1, 1-LS1-1

### **Light It Up!**

Plan and conduct investigations using flashlights and light boxes to focus on how differing materials are transparent, opaque, translucent, or reflective.

**NJSLS (Science):** Waves and Their Applications in Technologies for Information Transfer: 1-PS4-3

### **What's the Matter?**

Explore the colorful world of chemistry with investigations that allow students to describe and classify materials by their observable properties. Then apply your newly discovered evidence as we discuss whether or not various changes are reversible.

**NJSLS (Science):** Matter and Its Interactions: 2-PS1-1, 2-PS1-4

### **Ch-Ch-Ch-Changes!**

Our planet is constantly being shaped by events that can occur quickly or slowly. Using a model to represent land and bodies of water, students will simulate how glaciers and avalanches can change the shape of the land around us.

**NJSLS (Science):** Earth's Place in the Universe: 2-ESS1-1, 2-ESS1-2

# Live From Surgery

*Live From Surgery* opens a window into operating rooms while building knowledge through interactions with experts, such as surgeons and the medical team. This powerful learning experience connects students to careers in health science and biotechnology. Access to our exhibitions is included with the program and your group is free to explore the Science Center after your session.

Most programs can be transmitted into your classroom using distance learning technology.  
See page 30 for technology requirements.

Must be booked in advance. Call 201.253.1310.

Our *Live From Surgery* program now features three Meet the Surgeon sessions: Heart Transplant, Pediatric Orthopedic, and Neonatal Surgery. These sessions create an intimate environment where surgeons can focus their attention on the students, narrate the surgical procedures and discuss patient outcomes, face-to-face.

## Choose from:

- Cardiac/Valve Surgery | 2.5 hours  
(not available via videoconferencing)
- Heart Transplant/VAD | 2.5 hours
- Kidney Transplant | 2.5 hours
- Orthopedic Surgery | 2.5 hours
- Pediatric Orthopedic Surgery | 2.5 hours\*
- Neonatal Surgery | 2.5 hours
- Neurosurgery | 3 hours
- Robotic Surgery | 2.5 hours  
(not available via videoconferencing)

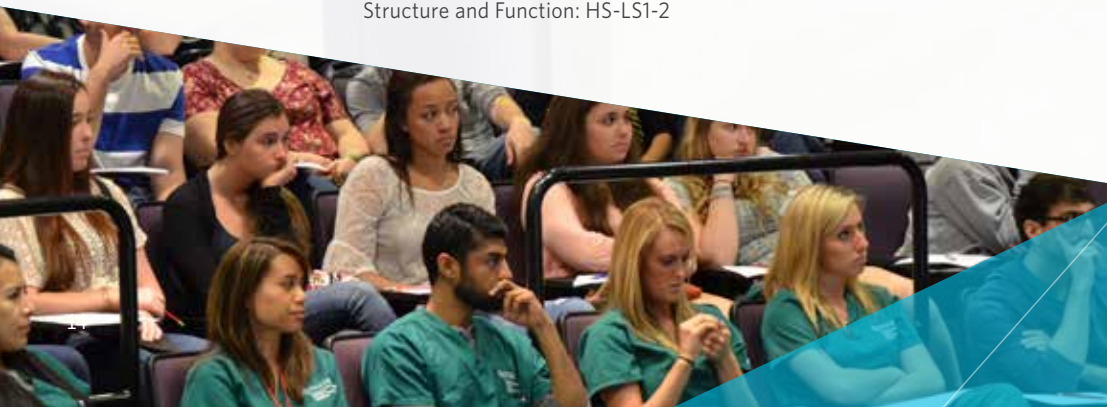
\* Note to elementary teachers: Interested in a surgical program? Try our Pediatric Orthopedic Surgery, appropriate for grades 3-12.

**NYCCLS:** 1, 2, 3a, 3b, 5, 6 & 7

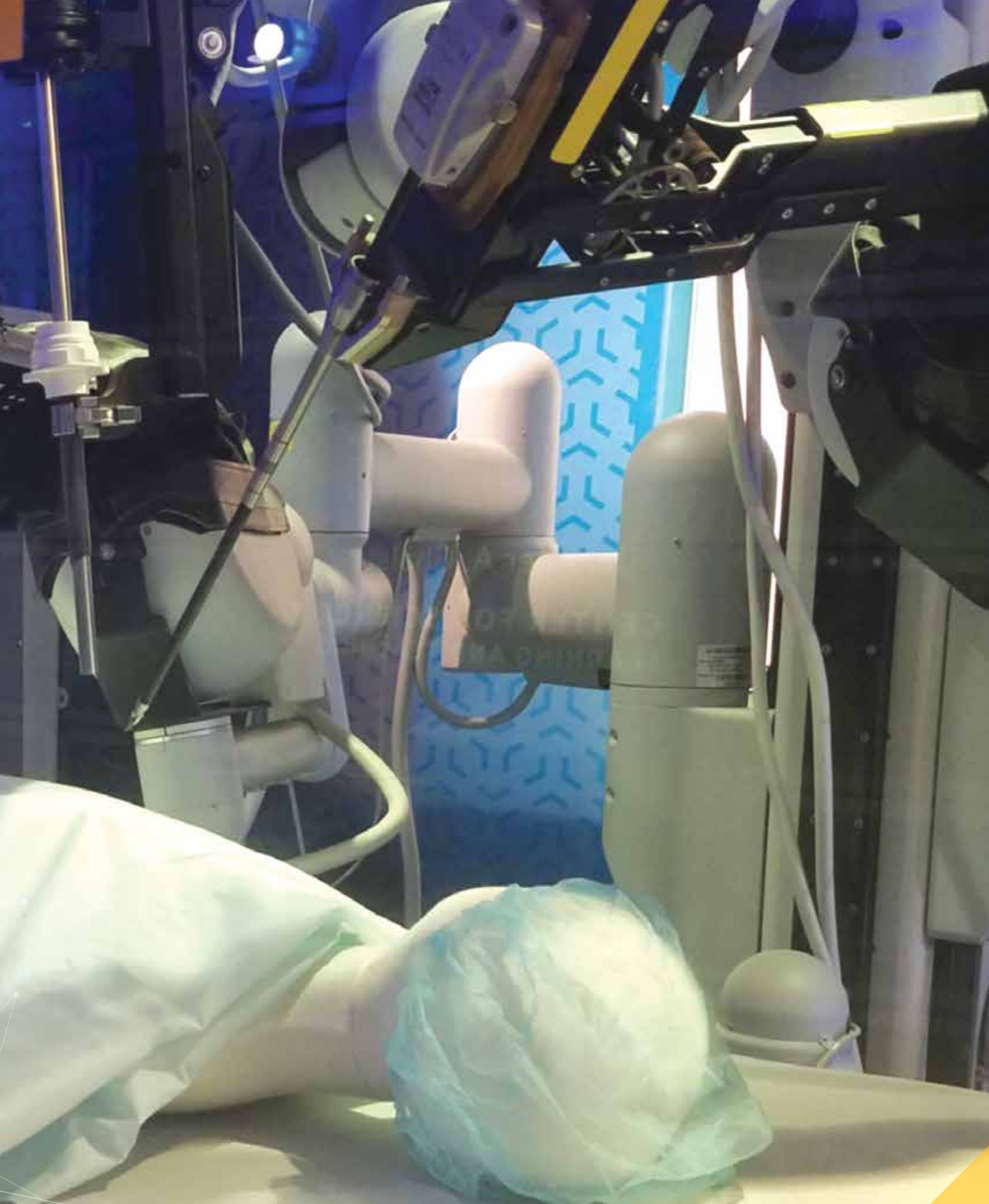
National Science Education Standards: M.C.1, M.C.1.f. & M.F.1.a.

National Health Education Standards: 1.12.4 & 7.12.1

**NJSLS (Science):** Structure, Function and Information Processing: MS-LS1-3  
Structure and Function: HS-LS1-2









# Half-Day Laboratory Workshops

Give your students the chance to more fully explore a subject with a Half-Day Laboratory Workshop. Programs support curriculum standards and multiple learning styles, and can be configured to fit your needs. Access to all of our exhibitions is included, and your group is welcome to explore the Science Center before or after your session.

**Grades:** 3-12

**Length:** 90 Minutes

Must be booked in advance.  
Call 201.253.1310.



## GRADES 3-5

### **NEW! Food, Glorious Food**

What does a food web represent? Discover the connection between producers and consumers of an ecosystem and how matter cycles through them as students assemble a 3D food web using local aquatic animals.

**NJSLS (Science):** Ecosystems: Interactions, Energy, and Dynamics: 5-LS2-1

### **NEW! Oh No, Oil Spill!**

Identify how oil spills can adversely affect our environment and ways that human beings can build solutions to this problem.

**NJSLS (Science):** Engineering Design: 3-5-ETS1-2  
Earth and Human Activity: 5-ESS3-1

### **NEW! Matter Matters**

Explore the basis of chemical changes by engaging in hands-on experiments to identify unknown substances by their properties. Students will investigate concepts such as hardness, chemical change, solubility, and others.

**NJSLS (Science):** Matter and Its Interactions: 5-PS1-3

### **Diversity of Life**

Explore the energy pyramid and learn about the relationships among producers, consumers, and decomposers. Interact with live plants and animals to see how their external structures help them grow and survive. Then explore the role fungi play in breaking down organisms and returning them to the soil.

**NJSLS (Science):** From Molecules to Organisms: Structure and Processes: 4-LS1-1, 5-LS1-1  
Ecosystems: Interactions, Energy, and Dynamics: 5-LS2-1

## GRADES 6-8

### **Understanding Gravity**

Gravity is one of the fundamental forces in the universe. Students will explore the combination of interactions that generate gravitational forces. Using an online simulation, students will explore and experiment with variables that govern the behavior of a body's gravitational field.

**NJSLS (Science):** Earth's Place in the Universe: MS-ESS1-2

### **Patterns in the Sky**

Students will embark on a journey through the Solar System! They will discover and model the lunar phases, the science behind seasons, stars, and the myths of the constellations.

**NJSLS (Science):** Earth's Place in the Universe: MS-ESS1-1

### **Urban Ecology**

What is the role of an ecologist? Students will learn about urban ecology as they interact with local wildlife, investigate human impacts on ecosystems, and solve an ecological mystery.

**NJSLS (Science):** Ecosystems: Interactions, Energy, and Dynamics: MS-LS2-4, MS-LS2-5  
Earth and Human Activity: MS-ESS3-4

## The World of Chemistry

Explore the basis of chemical change. Analyze and interpret data while engaging in hands-on activities that explain concepts such as reactions, acids and bases, electrolysis, mixtures and compounds, and many more.

**NJSLS (Science):** Structure and Properties of Matter: MS-PS1-1  
Chemical Reactions: MS-PS1-2

### **Crack the Case**

Discover how to collect evidence through real forensic techniques, such as blood typing, ballistics, fiber analysis, and more. Apply knowledge of these techniques to investigate a crime scene and solve the case.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-3  
Structure and Properties of Matter: MS-PS1-3  
Structure, Function, and Information Processing: MS-LS1-2  
Growth, Development, and Reproduction of Organisms: MS-LS3-1

### **Outbreak: Infections and Disease**

Dive into the field of epidemiology. Complete a disease transmission simulation to see how illness can spread through a community, then devise the best plan to control its spread based on given environmental factors. Explore methods microbiologists use to identify the organism responsible for an outbreak and formulate an effective treatment.

**NJSLS (Science):** Structure, Function, and Information Processing: MS-LS1-1  
Growth, Development, and Reproduction of Organisms: MS-LS1-5  
Engineering Design: MS-ETS1-1

## GRADES 9-12

### **Chemical Investigations**

Why is the periodic table that strange shape? Melt, dissolve, and electrify chemicals as you learn how to predict an element's properties by noting its place on the periodic table.

**NJSLS (Science):** Matter and Its Interactions: HS-PS1-1

### **Project Skyscraper**

Students will use modern surveying tools to learn concepts in math, engineering, and architecture and then integrate their results to build a scale model of One World Trade Center using their measured and calculated plans.

**NJSLS (Science):** Engineering Design: HS-ETS1-2

### **Changing Climates**

Using global climate models through our digital globes, students will collect average monthly temperature and precipitation data from NASA's Earth Observatory data repository. They will plot their data points on a climatograph, and explore what factors influence the type of climate observed in different locations on our planet and how the changes in these factors may impact or may be impacted by global phenomena.

**NJSLS (Science):** HS-ESS3-5

A photograph of students in a laboratory setting, wearing gloves and using tools to conduct experiments. The image is partially obscured by a blue geometric overlay on the right side of the page.

# Full-Day Laboratory Workshops

Give your students the chance to more fully explore a subject with a Full-Day Laboratory Workshop. Programs support curriculum standards and multiple learning styles, and can be configured to fit your needs. Access to all of our exhibitions is included, and your group is welcome to explore the Science Center before or after your session.

**Grades:** 3-12

**Length:** 2-4 hours per day

Must be booked in advance.  
Call 201.253.1310.

## GRADES 3-5

### **NEW!** Matter Matters

Explore the basis of chemical changes by engaging in hands-on experiments to identify unknown substances by their properties. Investigate concepts such as hardness, chemical change, solubility, and others.

**NJSLS (Science):** Matter and Its Interactions: 5-PS1-3

### **Not Just Bones**

Fossils tell a part of our planet's history. Step into the world of paleontology to study the different types of fossils, learn how fossils are created, and differentiate between fossils and non-fossils.

**NJSLS (Science):** Earth's Place in the Universe: 4-ESS1-1

### **Weathering Away**

Discover how tiny particles of minerals and rocks, called sediments, form. Investigate how rocks and minerals break down through chemical and physical changes, and are redistributed around the planet.

**NJSLS (Science):** Earth's Systems: 4-ESS2-1

### **Light it Up!**

Light up a room! Learn about electrical conductivity by making observations of energy transfer from electric currents to light. Design and test a flashlight using insulating and conducting materials.

**NJSLS (Science):** Energy: 4-PS3-2



## GRADES 6-8

### **NEW!** The Science of Taste

How do your taste buds work? Use real-world laboratory equipment to investigate how our genes influence what we like and dislike, and discover how genetic mutations make an evolutionary impact.

**NJSLS (Science):** Heredity: Inheritance and Variation of Traits: MS-LS3-1

### **NEW!** Building Blocks of Geology

Discover and analyze the ground below our feet. Classify and justify the classification of minerals and rocks found on Earth. Learn how to distinguish the natural processes of mechanical and physical forces that shape our world.

**NJSLS (Science):** Earth's Systems: MS-ESS2-1

### Elemental Attraction

Experiment with non-contact forces and their resulting fields. Learn how elementary particles govern the behavior of matter and how electrons in particular determine the behavior of electricity and magnetism.

**NJSLS (Science):** Motion and Stability: Forces and Interactions: MS-PS2-5

### Fiery Hazards

Classify and model the different types of volcanoes. Study a series of eruptions to discover how lava flow changes Earth's surface.

**NJSLS (Science):** Earth's Systems: MS-ESS2-2

### World Above Us

Discover and analyze the main components of the solar system. Explore and understand the importance of gravity, Earth's natural satellite, and much more.

**NJSLS (Science):** Earth's Place in the Universe: MS-ESS1-1, MS-ESS1-2, MS-ESS1-3

### Urban Ecology

What is the role of an ecologist? Learn about urban ecology through interactions with local NJ wildlife, investigate human impacts on ecosystems, and solve an ecological mystery.

**NJSLS (Science):** Ecosystems: Interactions, Energy, and Dynamics: MS-LS2-4, MS-LS2-5 Earth and Human Activity: MS-ESS3-4

### The World of Chemistry

Explore the basis of chemical change. Analyze and interpret data while engaging in hands-on activities that explain concepts such as reactions, acids and bases, electrolysis, mixtures and compounds, and many more.

**NJSLS (Science):** Structure and Properties of Matter: MS-PS1-1  
Chemical Reactions: MS-PS1-2

## GRADES 9-12

### Biodigital

What do proteins do? Uncover the myriad roles of proteins in this hands-on workshop. Investigate the molecular makeup of proteins, and experience the complexity and precision in protein folding configurations through computer programs and paper models.

**NJSLS (Science):** From Molecules to Organisms: Structure and Processes: HS-LS1-1, HS-LS1-3

### Unlocking Your DNA

Discover the world of genetics as you explore the human genome. Use hands-on lab techniques and lab equipment, such as micro-pipettes, centrifuges, and gel electrophoresis chambers, as you solve a genetic mystery.

**NJSLS (Science):** Heredity: Inheritance and Variation of Traits: HS-LS3-1  
Biological Evolution: Unity and Diversity: HS-LS4-3

### Thermal Motions

Investigate an exchange of thermal energies within a closed system. Analyze collected data to determine the amount of energy released within the closed system.

**NJSLS (Science):** Energy: HS-PS3-4

### Right Back at You

Through the construction of a reflectometer, explore the infrared radiation part of the electromagnetic spectrum by measuring the amount of energy an object radiates. Then use this information to model and interpret an infrared spectrum map.

**NJSLS (Science):** Earth's Systems: HS-ESS2-2

### Food Science

What are calories, and why are nutrients like carbohydrates and proteins important to health? Use indicators to test for the presence of nutrients in food, and solve a forensic food mystery.

**NJSLS (Science):** Energy: HS-PS3-1  
From Molecules to Organisms: Structures and Processes: HS-LS1-7

### Under the Sea

Discover the connections between biotic and abiotic factors of the ocean. Students will develop a model of ocean dynamics observing density differences and energy transfers while exploring biodiversity by investigating local NJ water samples.

**NJSLS (Science):** Ecosystems: Interactions, Energy, and Dynamics: HS-LS2-5  
Earth and Human Activity: HS-ESS3-1

### Forensic Investigations

Discover how to collect evidence through real forensic techniques, such as blood spatter, entomology, poisons and toxins, and more. Apply knowledge of the techniques just learned to investigate a crime scene and solve a crime.

**NJSLS (Science):** Structure and Function: HS-LS1-1, HS-LS1-2  
Inheritance and Variation of Traits: HS-LS3-1  
Matter and Its Interactions: HS-PS1-2  
Engineering Design: HS-ETS1-1, HS-ETS1-2

# NEW!

## MakerLab and Innovation Lab Programs

In two new, high-tech education spaces, LSC offers exciting programs to help you meet curriculum goals and reinforce science and engineering concepts with invaluable, hands-on experiences. Come for a few hours, a full day, or a themed series of workshops over the course of several weeks. These programs are aligned to the NJSLS (Science), ISTE standards, and/or Math Common Core Standards.

The **MakerLab** offers a variety of maker programs for middle and high school students. There is a 1:1 student to 3D printer ratio, allowing every student to work with their own printer in our programs. Additional equipment includes: vacuformer, laser cutter, 3D scanners, Arduino microprocessors, soldering stations, and a liquid resin 3D printer.

The **Innovation Lab** offers computer and technology programs for middle and high school students. There is a 1:1 student to computer ratio in all programs. A variety of programming languages are used in the workshops including: HTML, C+, and Java-script.

**Grades:** 6-12  
**Length:** 90 Minutes

Must be booked in advance.  
Call 201.253.1310.









## Half-Day Laboratory Workshops

### Scratch | Grades 6 - 8

Learn basic computer programming techniques with Scratch, a graphic user interface for drag-and-drop programming to develop a simple video game. Creatively use algorithmic thinking, systematic reasoning, and troubleshooting to develop and control your game. Additional workshop time allows for development of greater game complexity. Completed games can be downloaded at home.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-4  
ISTE: 1.b

### App Development | Grades 6 - 12

Learn basic computer programming techniques while building a simple Android-based mobile phone game. Use problem solving, creative thinking, and systematic reasoning to customize this app and incorporate math and Boolean logic to make it more complex. Download finished programs to students' personal Android phones to keep.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-4, HS-ETS1-2  
ISTE: 1.a, 1.b, 4.b

### Introduction to 3D Printing | Grades 6 - 12

Engage in online digital creation of 3D models and learn how to create intricate pieces designed for 3D printing. Walk away with a print of their personal designs and a printed LSC logo pin.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-2, HS-ETS1-2  
ISTE: 1.b, 4.b

### Advanced 3D Printing: Digital Editing | Grades 6 - 12

Learn how to use Pepakura in the creation of 3D printable origami. Choose from a wide variety of comic book characters, props, and video game helmets which they will be guided in customizing to be printed at home.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-2, HS-ETS1-2  
ISTE: 1.b, 3.c

### GIS Earthquakes | Grades 9 - 12

Use digital mapping software for Geographic Information Systems (GIS) to look at current and historic earthquake data and assess the earthquake risk of cities.

**NJSLS (Science):** Earth and Human Activity: HS-ESS3-6

## Full-Day Laboratory Workshops

### Scratch | Grades 6 - 8

Learn basic computer programming techniques and the programming platform Scratch to develop a simple game. Then use problem solving, creative thinking, and systematic reasoning to customize this game or work on new ideas. Develop increasingly complex programs using Boolean logic. Download all of your work after the workshop.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-4  
ISTE: 1.b, 4.b, 4.d

### Siege Engines | Grades 6 - 8

Engineers in the Middle Ages designed massive structures that were capable of hurling massive weights great distances. Use digital design tools to make 3D-printed catapults. Explore the physics that control accurate firing of these destructive machines with larger scale wooden models.

**NJSLS (Science):** Motion and Stability: Forces and Interactions: MS-PS2-1, MS-PS2-2  
Engineering Design: MS-ETS1-1, MS-ETS1-2, MS-ETS1-3  
ISTE: 1.b



### App Development | Grades 6 - 12

Learn basic computer programming techniques and the programming platform used in this workshop to develop a simple Android-based mobile phone game. Then use problem solving, creative thinking, and systematic reasoning to customize the app or work on another idea. Learn how math and Boolean logic principles can make these apps more complex. After the workshop, download and share finished apps to personal Android devices.

**NJSLS (Science):** Engineering Design: MS-ETS1-1, MS-ETS1-4, HS-ETS1-2  
ISTE: 1.a, 1.b, 3.a, 4.b

### Program, Aim, Fire! | Grades 6 - 12

Construct medieval trebuchets, and identify possible operational constraints. Then, through the use of the engineering design process and modern marvels such as programmable microcontrollers, improve the trebuchet's accuracy and distance.

**NJSLS (Science):** Motion and Stability: Forces and Interactions: MS-PS2-1, MS-PS2-2,  
Engineering Design: MS-ETS1-1, MS-ETS1-2, MS-ETS1-3

### 3D Printing: Engineering Design Challenge | Grades 6 - 12

Learn to use 3D printing to solve complex problems in a collaborative work group. Your group will be engaged in advanced 3D design with open source software. Walk away with a personal design and a 3D-printed LSC graduate pin, which can be wired and soldered with LEDs to add some sparkle!

**NJSLS (Science):** Engineering Design: MS-ETS1, HS-ETS1-2, HS-ETS1-3

### Mold Making and Vacuforming | Grades 6 - 12

Through the use of mold making, we will delve into modern day alchemy. Bring in small, unique items from home that can fit within a standard sized soup can. These will be used to create a mold. Learn to cast that mold with chocolate, gelatin, or candle wax to make a take-home souvenir. Master best practices for successful mold-making for open-face and two-part molds, and learn about thermoplastics and vacuforming processes. (Mold-making materials may be purchased following the class.)

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-3, HS-PS1-5

### HTML Globe Coding | Grades 9 - 12

Have you ever wanted to design your own museum exhibit? How about designing and seeing your own planet in 3D? Learn the basics of markup languages and digital media creation while controlling Liberty Science Center's 18-inch diameter digital globes used for displaying data sets from NASA. Customize a globe exhibit with changes to the HTML and XML documents and upload your imaginary planet's imagery to the globe display.

**NJSLS (Science):** Engineering Design: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3  
ISTE: 1.a, 1.b, 1.c, 2.b, 3.b, 3.c, 4.b

### Zombie Apocalypse | Grades 9 - 12

Geographic Information Systems (GIS) uncover relationships between sets of data points and locations, and are widely used in public health, transportation, science, and other fields. Learn to map and analyze spatial data (data with a location component). Identify local problems (perhaps a zombie uprising?), then use GPS coordinates from mobile devices to collect, map, and analyze related data. Discuss solutions to the problems, based on data.

**NJSLS (Science):** Engineering Design: HS-ETS1-1, HS-ETS1-3  
ISTE: 3.d, 4.c, 4.d

## Series Workshops (from 7 - 14 weeks)

### Scratch | Grades 6 - 8

Learn basic computer programming techniques with Scratch, a graphic user interface for drag-and-drop programming to develop a series of simple programs over a sequence of two-hour workshops offered for 7 or 14 weeks. Learn the core programming thought processes such as loops, conditional statements, variables, and control elements to develop ever more complex programs. Save your work into a personal Scratch account, and retain access to it following the completion of the course. The final program will be an individual project exhibiting the creative use of algorithmic thinking, systematic reasoning, and troubleshooting to develop and debug a unique game, story, or other program.

**Curriculum alignment details will vary with grade level, project, and duration of the series workshop.**

### Innovate, Inspire, and Engineer | Grades 6 - 8

What does it take to become a successful inventor? Find out in this series of two-hour workshops offered for 7 or 14 weeks. Learn the engineering design process and collaborate on solving challenges. Hands-on activities include circuitry, soldering, and programming Arduino microcontrollers. Projects will be tailored to student interests.

**Curriculum alignment details will vary with grade level, project, and duration of the series workshop.**







# Traveling After-School Programs

LSC brings science learning to you! Take part in hands-on, science-based programs one hour per week at your location. The workshop series provides project-based learning supported by development of critical thinking, collaboration, innovation, and problem solving over an extended period of time. We offer several program formats to meet your needs. Choose one or multiple sessions and select a range of topics, or build on the same topic over the course of several weeks.

We can configure TAP workshops to meet your needs. Contact an LSC representative for assistance planning a unique and unforgettable after-school science program for your school: 201.253.1310.

**Grades:** 1-12

**Length:** Single week or multi-week series

## **Some popular topics include:**

### **Forensic Science**

Crack a case using techniques used by real forensic scientists, such as checking for fingerprints, comparing fibers, the science of ballistics, DNA analysis, and more.

### **Growing Into Science**

Learn about a multitude of STEM career opportunities, and see how science fits into your future! We provide opportunities for exciting science learning using experiential, hands-on models that cannot always be replicated in the traditional school environment.



# Traveling Science Programs

Our specially-trained educators deliver dynamic and memorable science programs at your school. We offer shows for large audiences (assemblies) and individual classes (classroom workshops) on a wide range of STEM topics and can travel within a 140-mile radius of Jersey City, NJ.



## ASSEMBLIES

Add STEM learning to your cultural arts program this year with one of our highly entertaining assemblies.

**Grades:** K - 8

**Length:** 45-60 minutes

**Group Size:** Maximum of 300 students per show

### Little Dragon's Digestive System | Grades K - 1

Meet Sam, a dragon with bad eating habits, and take a journey through the digestive system. A few lucky volunteers climb into a giant mouth, slide down an esophagus, and end up in a churning stomach before squeezing through the intestines. Everyone learns all about the parts of the digestive system and how they work together to give humans the nutrients we need.

**NJSLS (Science):** From Molecules to Organisms: Structures & Process: K-LS1-1

### Flash! Bang! All About Natural Gas and Electricity Grades 1 - 4

Arcing electricity. Balls of fiery gas. Join us for an interactive look at the two most common forms of home energy, clear examples of science affecting everyday activity. Let's generate electricity, explore insulators and conductors, and participate in our very own game show, all while learning how to avoid the hazards inherent in using natural gas and electricity.

**NJSLS (Science):** Energy: 4-PS3-2

### Science Circus | Grades 1 - 8

It's our most popular show! Explore the positives and negatives of static electricity, the sub-zero temperatures of liquid nitrogen, the states of matter, and the immense pressure of air. Includes over a dozen thrilling experiments and, as always, we use lots of volunteers. It's a great way to showcase the concepts of energy and matter.

**NJSLS (Science):** Matter and Its Interactions: 2-PS1-1, 2-PS1-4, 5-PS1-1, MS-PS1-4  
Motion & Stability: Forces and Interactions: 3-PS2-3



Add some hands-on science flair to your school science fair or special event! Our staff can lead a hands-on activity station that complements your theme. Call 201.253.1310.

### A Dose of Gross | Grades 4-6

Your body carries out many "gross" functions, like burping and sweating, but it does so for very important reasons. Take a journey through the human body to discover how your brain makes decisions, without your knowing it, to keep you healthy and strong by controlling the various organ systems of the body.

**NJSLS (Science):** From Molecules to Organisms: Structure & Processes: 4-LS1-1, 4-LS1-2, MS-LS1-1, MS-LS1-2, MS-LS1-3

### Science Sportacular (Newton's Laws) | Grades 4-8

Sports all have one thing in common—science. We demonstrate Newton's Laws and cause and effect using sports equipment. Students learn how a pitcher makes a baseball curve and volunteers join in a momentum race. We even demonstrate concepts related to helmet safety by lying on a bed of sharp nails. No tricks or illusions here, just pure science.

**NJSLS (Science):** Energy: 4-PS3-1, 4-PS3-3  
Motion & Stability: Forces & Interactions: MS-PS2-1

### Science of Flight | Grades 4-8

Most of us have probably wondered how aircraft fly. While it might seem to be impossible, or magical, it's really just science. Take a closer look at the four forces of flight and aviation in an educational and entertaining way!

**NJSLS (Science):** 3-PS2-1, 3-PS2-2, MS-PS2-2



## CLASSROOM WORKSHOPS

For in-depth learning with plenty of individual attention and participation, Classroom Workshops are the way to go. Workshops for Pre-K and K students are 40-45 minutes long and can be presented up to three times for a maximum of 25 students per session. Workshops for students in grades 1 - 10 are 45 minutes long and can be presented up to three times for 30 students per session.

**Grades:** Pre-K - 10

**Length:** 40-45 minutes

### Pumpkin Circle | Grades Pre-K to K

After reading *Pumpkin Circle, the Story of a Garden* by George Levenson, we explore real pumpkins and appreciate the life cycle of plants.

*Offered September through November*

**NJSLS (Science):** From Molecules to Organisms: Structures & Processes: K-LS1-1

### The Skeleton Inside You | Grades Pre-K to K

Why do we have bones? What are they made of? How is their structure related to their function? What happens when they break? Discover these answers and many more as we learn all about bones in the story of *The Skeleton Inside You* by Philip Balestrino. After reading our story, craft your own 'broken bone' and mend it with a cast.

**NJSLS (Science):** Engineering Design: K-2-ETS1-2

### Flow Motion | Grades K - 2

Learn the basics of the water cycle in this highly interactive program. Through active listening, investigation, and kinesthetic role-play, understand the main processes of the water cycle, from the sun warming Earth to the various forms water can take. Follow the leader as we become water droplets and complete our journey.

**NJSLS (Science):** Energy: K-PS3-1

Earth's Systems: 2-ESS2-3



### Creepy Crawlies | Grades K - 4

Giant Madagascar hissing cockroaches, tarantulas, and other wonderfully wiggly creatures visit your classroom in this hands-on workshop. Learn the important ecological roles these strange and wonderful animals play. Note: Snakes are not available in the winter.

**NJSLS (Science):** From Molecules to Organisms: Structures & Processes: 1-LS1-1  
Biological Evolution: Unity & Diversity: 2-LS4-1

### The Power of Air | Grades K - 4

Experience first-hand how surprisingly strong air can be by conducting experiments with air pressure in this interactive workshop. Discover the underlying principles of what makes wind, how suction cups work, and why airplanes fly.

**NJSLS (Science):** Motion & Stability: Forces & Interactions: K-PS2-1; 3-PS2-1; 3-PS2-2

### Electricity and Magnetism | Grades 2 - 5

Learn about the structure of atoms, the relationship between electricity and magnetism, and where static electricity comes from in this highly interactive and hair-raising exploration of positive and negative charges.

**NJSLS (Science):** Motion & Stability: Forces & Interactions: 3-PS2-3  
Matter and Its Interactions: 5-PS1-3

### Owl Pellet Dissection | Grades 2 - 5

Explore the diet of these nighttime raptors by examining undigested remains of their prey. Dissect an owl pellet with a partner, and identify what the bird consumed. This is a great introduction to the food web and to vertebrate anatomy.

**NJSLS (Science):** From Molecules to Organisms: Structures & Processes: 4-LS1-1

### The States of Matter | Grades 2 - 6

Using super-cold liquid nitrogen, common household items, and volunteers, we demonstrate how things change from solid to liquid to gas. Observe and provide explanations for these changes through this really cool exploration of matter.

**NJSLS (Science):** Matter and Its Interactions: 2-PS1-1, 2-PS1-4, 5-PS1-1, MS-PS1-4

### Balls and Tracks | Grades 3 - 7

What forces of science help ski jumpers become champions? Using marbles as “ski jumpers,” this hands-on program introduces the fundamental laws of motion and shows their effect on how far and fast a ski jumper can go. Explore cause and effect and use data to predict the final jump distance.

**NJSLS (Science):** Motion & Stability: Forces & Interactions: 3-PS2-1; 3-PS2-2  
Energy: MS-PS2-2

### Swell Cells | Grades 5 - 8

Explore the crosscutting concept of structure and function in the human body from the cells up. Build a model cell and learn how cells with similar structures form tissues. These tissues then create organs, whose job is to create systems that make the body work.

**NJSLS (Science):** From Molecules to Organisms: Structures & Processes: MS-LS1-2, MS-LS1-3

### Energy: Use It and Lose it | Grades 6 - 9

Energy comes in many forms; we use it and lose it every day. Use hands-on experiments to track energy flow in a series of transformations that produce both useful actions and losses.

**NJSLS (Science):** Energy: MS-PS3-5

### Chemistry of the Stars | Grades 6 - 10

How do astronomers determine the chemical composition of stars millions of light years away? Learn about atomic spectra, flame tests, and other scientific tools used to uncover the underlying structure and function of the elements that compose all matter. Collect and analyze the patterns of spectra from fluorescing elements.

**NJSLS (Science):** Earth's Place in the Universe: HS-ESS1-3

### Cow Eye Dissection | Grades 6 - 10

Follow light on its journey through the eye. Perform cow eye dissections in pairs to gain a deeper understanding of the structure and function of the human eye.

**NJSLS (Science):** From Molecules to Organisms: Structures & Processes: MS-LS1-3

### The Right Stuff: The Science of Materials | Grades 6 - 10

Explore the exciting world of materials science by learning about the properties and structures of metals, ceramics, and polymers (plastics). See metal that “remembers” its shape and tin foil being made right before your eyes. Students will learn how the underlying structure of a material determines its function and suitability for a specific need.

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-1; MS-PS1-3  
Motion and Stability: Forces & Interactions: HS-PS2-6



The background of the slide features a close-up photograph of a red ant walking on a weathered wooden log. The ant is carrying a small, curled piece of green leaf in its mandibles. The background is a soft-focus green, suggesting a forest setting. In the top-left corner, there is a blue geometric overlay with a network of white dots and lines connecting them, resembling a molecular or digital structure.

# Electronic Field Trips

These two-way interactive sessions take full advantage of Liberty Science Center's exhibitions and lab facilities from the comfort of your own location. Our dynamic instructors use videoconferencing to bring exciting, cross-curricular programs into your classroom.

Technology requirements:

Choose between computer-based videoconferencing or IP videoconferencing.

Computer-based requirements:

- Best accessed through a PC or MAC connected to an LCD screen, overhead projector, or Smartboard
- Camera that is built in or integrated through USB port
- USB Microphone
- Speakers

IP videoconference requirements:

- Videoconferencing hardware (ex. Polycom / LifeSize)
- Minimum connection speed of 384 kbps



## **NEW! Virtual Science Demonstrations**

**Grades:** 2-8

**Length:** 25 minutes

**Maximum:** 35 students per connection

### **NEW! Chemical Reactions**

Choose one of the following reactions to support your students' learning: decomposition, single replacement, double replacement, synthesis, or combustion.

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-5

### **NEW! Animal Adaptations | Grade 3 - 8**

Animals from our collection illustrate how traits can be influenced by the environment and how variations of traits in a population increase some animals' probability of surviving and reproducing in a specific environment.

**NJSLS (Science):** Heredity: Inheritance and Variation of Traits 3-LS3-2  
Biological Evolution: Unity and Diversity MS-LS4-4

### **NEW! Forensic Science: Gotham Detective | Grade 6 - 12**

**This program includes a kit and a 45-to-60-min videoconference.**

Conduct an investigation and analyze evidence to build a case against one of the city's notorious criminal masterminds before it's too late.

**NJSLS (Science):** Matter and Its Interactions: MS-PS1-3, Structure and Function: HS-LS1-3

## **E-Connections**

**Grades:** 2-8

**Length:** 45 minutes

**Maximum:** 35 students per connection

### **Aquatic Ecosystem | Grade 5**

How is water distributed around the planet, and how does the distribution affect life on Earth?

**NJSLS (Science):** Earth Systems: 5-ESS2-2

### **Astronomy: Gravity | Grade 6 - 8**

Explore the role of gravity in the motions within galaxies and the solar system.

**NJSLS (Science):** Space Systems: MS-EES1-2

### **Chemistry of Mixtures, Solutions, and More |**

**Grades 5 - 8**

Learn the differences between chemical and physical changes, then separate materials based on their properties and learn about the roles of reactants and products.

**NJSLS (Science):** Chemical Reactions: MS-PS1-2

### **Circles to Circuits Grades | 4 - 8**

To understand complex machines like computers and robots, we must first figure out the basic relationship between atoms and electricity. Construct your own circuits and build an understanding of electricity, insulators, and conductors.

**NJSLS (Science):** Forces and Interactions: MS-PS2-3  
Engineering Design: MS-ETS1-1

### **Eat and Be Eaten | Grade 3**

It's a dog eat dog world. In a particular habitat, learn which organisms can survive well, which ones struggle to survive, and which ones cannot survive at all.

**NJSLS (Science):** Biological Evolution: Unity and Diversity: 3-LS4-3

### **Geometry in Nature | Grades 2 - 5**

Classify different kinds of materials by their observable properties.

**NJSLS (Science):** Structure and Properties of Matter: 2-PS1-1, 5-PS1-3

### **Beehavin' | Grades 3 - 6**

Insects cannot talk, but they communicate in many more ways than we do. Visit our display hive to watch honey bees in action and see them fly off to forage nectar from flowers in Liberty State Park.

**NJSLS (Science):** Interdependent Relationships in Ecosystems: 3-LS2-1

### **Mutualism | Grades 6 - 8**

Discover how animal behaviors and specialized plant structures affect the probability of successful reproduction of each species.

**NJSLS (Science):** From Molecules to Organisms: Structures and Processes: MS-LS1-4

### **Plants | Grade 5**

Investigate plants and how they get the materials they need for growth chiefly from air and water.

**NJSLS (Science):** From Molecules to Organisms: Structures and Processes: 5-LS1-1

### **Renewable Energy | Grades 4 - 8**

As non-renewable energy sources like coal and oil dwindle, we need to look to other sources such as sun, wind, and water. Explore our *Energy Quest* gallery and experiment with a variety of renewable energy sources.

**NJSLS (Science):** Energy: 4-PS3-4, MS-PS3-4

### **Weathering and Erosion | Grades 4 - 8**

Earth is constantly changing. Although some changes happen quickly, others occur over long periods of time. Using "The Forces of Change" animation in *Our Hudson Home*, explore how this area has changed over the eons.

**NJSLS (Science):** History of Earth: MS-ESS2-2

Earth's Systems: Processes That Shape the Earth: 4-ESS1-1, 4-ESS2-2

### **Live From Surgery | Grades 3 - 12**

**(see page 15 for details)**

**Choose from:**

Heart Transplant/VAD | 2.5 hours

Kidney Transplant | 2.5 hours

Neonatal Surgery | 2.5 hours

Neurosurgery | 3 hours

Orthopedic Surgery | 2.5 hours

Pediatric Orthopedic Surgery | 2.5 hours

# Free Preview Days

Parents and teachers are vital to the future of our children and we applaud your dedication to making each school year enriching and memorable. Learn how our programs and robust hands-on experiences can focus and improve student learning and support teachers. Please join us for a free, enjoyable, and informative LSC preview event.

## **Participants will enjoy:**

- Two professional development hours
- Breakfast and networking
- Exploring our labs
- Live demonstrations
- STEM program and workshop previews
- Free raffles
- A complimentary film
- A 20% discount at the gift shop
- Free exploration of the center for the rest of the day
- Discount for family members to visit the center during the event\*

## **Teachers**

10:00 am - 1:00 pm  
January 21, 2017  
June 3, 2017

## **Parents & Teachers**

10:00 am - 1:00 pm  
March 25, 2017

The event is free, but space is limited. Register at [lsc.org/preview](http://lsc.org/preview) or email Lauren Rose at [lrose@lsc.org](mailto:lrose@lsc.org).

\*Bring your family to explore the center while you're at the event at a discounted rate of \$11.75 per person. Accompany your guests to the Box Office for the discounted rate. Inform the Box Office attendant that you are with the preview event to ensure you receive the special rate. Adults only at the preview event, please! Thank you for your cooperation.

Liberty Science Center is a registered professional development provider with the NJ Department of Education, provider #1033. Parking is available in our convenient, on-site lot at \$7 per car.





# Teacher Professional Development Workshops

Teachers face new challenges as the NJSLS are adopted and implemented. With an increased emphasis on evidence-based learning, exploration of science phenomena, and scientific discourse, educators need professional development experiences that reflect these new focal points of learning. Liberty Science Center can partner with your school or district to offer engaging and effective professional development programs tailored to planning for and implementing the NJSLS.

You can even combine PD with student programs like Electronic Field Trips or Extended Laboratory Workshops to observe and learn from LSC educators in real time, with real students.

To learn more, contact Mary McDonald at [mmcdonald@lsc.org](mailto:mmcdonald@lsc.org) or 201.253.1214.





## NEW Workshop Series for the 2016 - 2017 School Year

### Liberty Science Center NJSLs (Science) Master Teacher Institute

This professional development series offers comprehensive training in incorporating the NJSLs (Science) in the classroom. The content of each of these sessions can be customized for elementary, middle school, or high school teachers. The workshops may also be offered à la carte, upon request.

#### ***NJSLs (Science) Overview: Teaching Science in Three Dimensions***

This workshop introduces the NJSLs (Science), highlighting key shifts in content and practices that the new standards bring to classrooms. Educators will become familiar with teaching through the three strands of NJSLs (Science): Disciplinary Core Ideas, Science and Engineering Practices, and Crosscutting Concepts. They will also have the opportunity to review their current science lessons and make amendments to reflect NJSLs (Science) teaching and learning practices. Successive workshops will focus in depth on each Science Practice, Disciplinary Core Ideas, and various Crosscutting Concepts.

#### ***Asking Questions and Science Investigation Design/Implementation***

**Focus:** The first and third Science Practices: Asking Questions and Planning and Carrying Out Investigations. Take part in NJSLs (Science)-based investigations that highlight the efficacy of these two Science Practices. Reflect on the science investigations in order to modify existing science lessons to be aligned to these Science Practices.

#### ***Analyzing and Interpreting Data***

**Focus:** The Science Practice of Analyzing and Interpreting Data as well as the Crosscutting Concept of Patterns. Conduct science investigations that highlight the importance of data in science teaching and learning. Reflect on these investigations to plan modifications of current science lessons for best NJSLs (Science) alignment.

#### ***Developing and Using Models***

**Focus:** The Science Practice of Developing and Using Models as well as the Crosscutting Concept of Systems and System Models. Deepen understanding of these aspects of NJSLs (Science) and participate in engaging science lessons. Upon reflection on the workshop sample investigations, modify existing science lessons in order to make them better aligned to NJSLs (Science).



Last year, 1,200 science teachers participated in LSC's Professional Development programs.

#### ***Evidence-Based Explanations and Argumentation***

**Focus:** Two Science Practices: Constructing Explanations and Engaging in Argument from Evidence. Conduct investigations that require collecting data and other evidence that will form the foundation for constructing explanations and engaging in evidence-based science argumentation. Based on this learning, modify existing science lessons to be better aligned to NJSLs (Science).

#### ***Teaching Science with Crosscutting Concepts***

**Focus:** Crosscutting Concepts across the various Disciplinary Core Ideas. Take part in exemplary science investigations that highlight various aspects of these concepts, then modify existing science lessons to be better aligned to NJSLs (Science).

#### ***Planning NJSLs (Science) Aligned Science Units and Lessons***

**Focus:** Planning a unit of lessons that align to the three strands of the NJSLs (Science). Engage in science investigations that are part of the sample science unit. Then reflect on this learning and modify existing science lessons to be better aligned to NJSLs (Science).

#### ***Integrating NJSLs (Science) with Common Core ELA and Math Standards***

**Focus:** Learning synergies between NJSLs (Science) and Common Core ELA and Math Standards. Engage in exemplary investigations which illustrate Mathematics and Computational Thinking, Engaging in Argument from Evidence, and Obtaining Evaluation and Communicating Information. Gain mastery in modifying existing science lessons to emphasize connections between NJSLs (Science) and Common Core ELA and Math Standards.

#### ***Problem-Based Learning through the NJSLs (Science) Engineering Practices***

**Focus:** Integrating the NJSLs (Science) Engineering Practices in the science classroom. Participate in problem-based science investigations that use the NJSLs (Science) Engineering Practices. Reflect on this learning, then modify science units and curriculum to integrate NJSLs (Science) Engineering Practices.

## 3-Hour Professional Development Workshops

### GRADE K - 8 TEACHERS:

#### It's All in the Question

Effective hands-on science instruction encourages students to make observations, manipulate data, construct explanations, and design solutions. Learn how to stimulate student thinking by helping them make predictions, plan and carry out investigations, and respond to open-ended questions.

**NJSLS (Science):** PS1A: Structure and Properties of Matter; PS2B: Types of Interactions; PS3C: Relationship between Energy and Forces

#### Science Grabbers

Prepare a hands-on survival kit with activities for all science disciplines. Plan and conduct science investigations in various content areas and explore cause-and-effect relationships, energy transfer, and properties of matter.

**NJSLS (Science):** PS1A: Structure and Properties of Matter; PS1B: Chemical Reactions; LS1C: Organization for Matter and Energy Flow in Organisms

#### Earth, Moon, and Stars

Explore interrelated concepts in earth, space, and physical science with a focus on how forces such as gravity interact with planets, the Moon, stars, and humans. Collect and analyze data on planetary cause and effect; develop, scale, and use models to understand relative sizes in the solar system; and compare patterns and cycles.

**NJSLS (Science):** ESS1A: The Universe and Its Stars; ESS1B: Earth and the Solar System

#### The Human Body: Getting to Know Me

Amaze your students with comparative exercises that offer a deeper look into the structure and function of their own bodies. Explore skeletal development, the senses, and human information processing.

**NJSLS (Science):** LSS1A: Structure and Function

#### Micro-Observations

Reveal ordinary things in an extraordinary way with our indestructible classroom microscopes. Learn how to plan and implement science investigations that use magnification as a springboard to gather and analyze meaningful data on the concepts of scale, structure, and function.

**NJSLS (Science):** LSS1A: Structure and Function; ESS2A: Earth Materials and Systems

#### Matter, Matter, Everywhere

Spark critical thinking and good communication skills as you investigate the structures and properties of solids, liquids, and gases. Measure, combine, and classify changes and reactions in substances by touching, manipulating, and even tasting the results. Sweet!

**NJSLS (Science):** PS1A: Structure and Properties of Matter; PS1B: Chemical Reactions

#### The L.A.W.S. of Weather

Discover how weather develops as land, atmosphere, water, and sunlight interact. Conduct easy experiments on the properties of air, create a model water cycle in a cup, and construct and test simple weather instruments. Use these instruments to gather and analyze meteorological data.

**NJSLS (Science):** ESS2C: The Role of Water in Earth's Surface Processes; ESS2D: Weather and Climate

#### Earth's History: Written in the Rocks

Investigate Earth's history by making soil, sampling soil, and exploring natural forces. Learn about scale, system models, and stability and changes in Earth systems. Use models that illuminate aspects of our planet, and analyze and interpret data to better understand Earth's processes.

**NJSLS (Science):** ESS1C: The History of Planet Earth; ESS2A: Earth Materials and Systems; ESS2C: The Role of Water in Earth's Surface Processes

#### Eco-Awareness

Use hands-on activities to explore natural materials and resources. Examine the beneficial and harmful impacts humans can have on local and global ecosystems. Explore system models that illuminate the delicate balance found in ecosystems.

**NJSLS (Science):** LS2A: Interdependent Relationships in Ecosystems; LS2B: Cycles of Matter and Energy Transfer in Ecosystems; ESS2A: Earth Materials and Systems

#### What's So Simple about Simple Machines?

Explore new ways to teach a simple machines unit with emphasis on readily available materials. Define and explore problems that can be addressed by simple machines and design solutions based on the efficacy of particular machines that address a particular design challenge. Collect data to explain how simple machines work and use these concepts to think about how simple machines can be used to streamline everyday tasks.

**NJSLS (Science):** PS2A: Forces and Motion; PS2B: Types of Interactions

### GRADE 7 - 12 TEACHERS:

#### Unpacking the NJSLS (Science)—Planning 3-Dimensional STEM Lesson Elements

As you plan for and implement the new standards, LSC can partner with you to evaluate and adapt your curricular models, lesson design, and pedagogy to capitalize on your current strengths and incorporate NJSLS (Science) requirements. This course can be customized in content emphases, grade level bands (K - 4, 5 - 8, 9 - 12) and length (one day through multi-day) to complement your school district's needs and schedule.

#### Math and Science Connection Workshop

Learn to collect, analyze, and interpret data. Explore patterns, proportion, and quantitative analysis. Work with early calculators, study the applications of probability, explore Platonic solids, and construct flexagons. Learn about Fibonacci numbers, graphing collected data, the golden mean, and more.

**NJSLS (Science):** Interdependent Relationships in Ecosystems: HS-LS2-2

#### Intermediate Science Sampler

It's one of our most popular programs for middle school teachers. Use activities to initiate discussion and introduce areas of scientific inquiry from topology and color vision to a simulation of the spread of communicable disease. Use observable data to draw conclusions and deepen understanding of scientific concepts.

**NJSLS (Science):** Structure, Function and Information Processing: MS-LS1-8



## Explorations in Ecology

Uncover the basics of ecology using math, simulations, and graphs to understand predator-prey relationships, population growth, photosynthesis, biome comparisons, and endangered species. This in-depth view of ecological principles is appropriate for grade 6 - 9 teachers.

**NJSLS (Science):** Interdependent Relationships in Ecosystems: MS-LS2-2; Matter and Energy in Organisms and Ecosystems: MS-LS1-6

## Hidden Worlds Revealed through the Microscope

Learn to use microscopes more effectively by examining pennies, feathers, fingerprints, and preserved and living organisms. Explore concepts of scale, structure, and the functions of tiny items and organisms. Plan and implement investigations that provide meaningful data about the intricacies of items visible only on a microscopic scale.

**NJSLS (Science):** Structure, Function and Information Processing: MS-LS1-1

## Exploring Matter: The Chemistry of the Universe

Collect, analyze, and interpret data on the physical and chemical properties of matter as well as changes produced by chemical combinations. Create a brochure about a favorite chemical, use enzymes to convert milk into cheese, make a pH indicator from cabbage leaves, investigate the incredible absorption power of disposable diapers, and extract DNA from wheat.

**NJSLS (Science):** Structure and Properties of Matter: MS-PS1-4; Chemical Reactions: MS-PS1-2

## Plants and Insects: Perfect Together

Explore insect senses and behaviors, then discover how plants reproduce, grow, make food and, in some cases, even capture and consume insects. Analyze and interpret data related to plant and animal structures, their functions, and their interconnectedness.

**NJSLS (Science):** Structure, Function and Information Processing: MS-LS1-1; Inheritance and Variance of Traits: HS-LS3-3

## The Nervous System and Behavior

Examine the biological basis of behavior by studying the neuron, nerve impulse, and anatomical structure of vertebrate nervous systems, with an emphasis on the brain. Exciting activities cover visual perception, illusions, learning and memory experiments, reflexes, measuring the speed of a nerve impulse, and constructing a model human brain. Particular emphasis is placed on exploring concepts of biological cause and effect as well as the structure and function of the central nervous system.

**NJSLS (Science):** Structure, Function and Information Processing: MS-LS1-8

## Full-Day Professional Development

### 5-HOUR WORKSHOPS

#### Teaching the NJSLS (Science) Disciplinary Core Ideas: Earth Systems, Human Impacts, and Human Sustainability Using Real Earthquake Location Data

Enhance plate tectonics, natural hazards, and human impact lessons using real earthquake data. Explore an online global earthquake database using NJSLS (Science)-focused lessons.

**NJSLS (Science):** Earth's Systems: Processes that Shape the Earth: 2-ESS1-1, 4-ESS2-2 Earth's Systems: MS-ESS2-1, HS-ESS2-2, HS-ESS2-3 Human Impacts: MS-ESS3-2, HS-ESS3-3

## Engineering the Design Process in Robotics

Engineering practices are part of the new standards. Are you ready to take the design process beyond bridges and buildings? Explore these practices through the topic of robotics. Engage in collaborative work with fellow teachers to design, build, and program a functional robot. Concepts introduced will include the design process, algorithmic thinking, computer programming, mechanical and electrical systems, and integrating these ideas in your classroom. This workshop is intended as an introductory look at engineering design.

**NJSLS (Science):** This workshop addresses the Engineering Practices Performance Expectations for Elementary School, Middle School and/or High School.

## Teaching Science Using Multiple Intelligences

Discover how the eight intelligences can be focused for science instruction. Complete a multiple intelligence inventory and develop strategies to use in lesson design and implementation. Learn how to incorporate all facets of students' intelligence in science and engineering instruction.

**NJSLS (Science):** Multiple intelligences can be applied to all science standards.

## Integrating Science, Math, and Literacy: Activities for Pre-K to Grade 4 Classrooms

Connect mathematics, literacy, and science concepts. Using a wide variety materials and objects, investigate topics in life, physical, earth, and space sciences, as well as in early engineering and design practices.

**NJSLS (Science):** PS1 Matter and Its Interactions, LS2 Ecosystems: Interactions, Energy, and Dynamics, ESS2 Earth's Systems

## Effectively Integrating Technology in Science Teaching

Gain hands-on experience with technologies found in many classrooms, including those students bring to school, and learn about the fundamental pedagogy underlying their use. Discover cutting-edge methods to more effectively engage students in science and engineering practices.

**NJSLS (Science):** This workshop addresses all the Engineering Design Performance Expectations for Middle School and/or High School with the goal of assisting teachers with effectively using technology to improve student learning.

## Teaching with Data in the Science Classroom

Develop a pedagogical framework to support students engaged in scientific inquiry. Learn to operate our Global Microscope, a stunning 18-inch spherical data display screen, then borrow it to use in the classroom. Emphasis is placed on increasing participants' proficiency in analyzing and interpreting data.

**NJSLS (Science):** Earth's Systems: HS-ESS2-2; Weather and Climate: HS-ESS3-5; Human Sustainability: HS-ESS3-6







# SU+RE House

Come explore the SU+RE House. Designed by Stevens Institute of Technology students, this house was the winning entry in the 2015 Solar Decathlon, sponsored by the US Department of Energy.

The SU+RE team merged the efficient indoor/outdoor rooms and open floor plan of a 60s-style beach cottage with state-of-the-art building science, the latest renewable energy technologies, and fiber-composite materials repurposed from the boat-building industry. The result is a building armored against extreme weather that uses 90% less energy than its conventional cousins, powers itself through clean solar energy, and becomes a hub for emergency power to the neighborhood in the aftermath of a storm.

Engage in a hands-on workshop while exploring the SU+RE House.

Workshop content can include:

- Exploring Renewable Energy
- Introduction to Electronics
- Energy Audits
- Insulation Lab
- Green Roof Construction
- Beach Erosion
- Tropical Storm Systems

Call us to find out how your students can learn in the SU+RE House! And please see our website for exciting new SU+RE House programs, updated throughout the year.



# NEW! Laser Shows in the IMAX Dome

***Legends of the Night Sky: Perseus & Andromeda* (18 minutes)**

September - December: 10:30 am Tuesday - Friday

***Legends of the Night Sky: Orion* (20 minutes)**

January - June: 10:30 am Tuesday - Friday

Learn the myths and legends associated with the constellations Perseus and Andromeda in the fall sky and Orion the Hunter in the winter sky. The shows bring the mythological figures to life in full-color laser light. Both follow the original Greek myths. The accuracy to the Ovid version of Perseus and Andromeda is exceptional. Join us on this lighthearted and imaginative journey!

## COMING IN DECEMBER 2017 The Jennifer A. Chalsty Planetarium

LSC has the largest domed theater in North America. Thanks to a recent \$5 million gift from philanthropist Jennifer A. Chalsty, the 400-seat dome will be converted into both a state-of-the-art digital theater and the largest and best planetarium in the Western Hemisphere. We expect to welcome our first planetarium audiences in December 2017.

The planetarium environment is fully immersive. Students will be able to move forward and backward in time, and travel from the surface of the Earth to the edge of the Universe while exploring astronomical objects along the way. School groups can experience celestial events in real time with support and instruction from our expert STEM educators. Get ready for a whole new place in space!