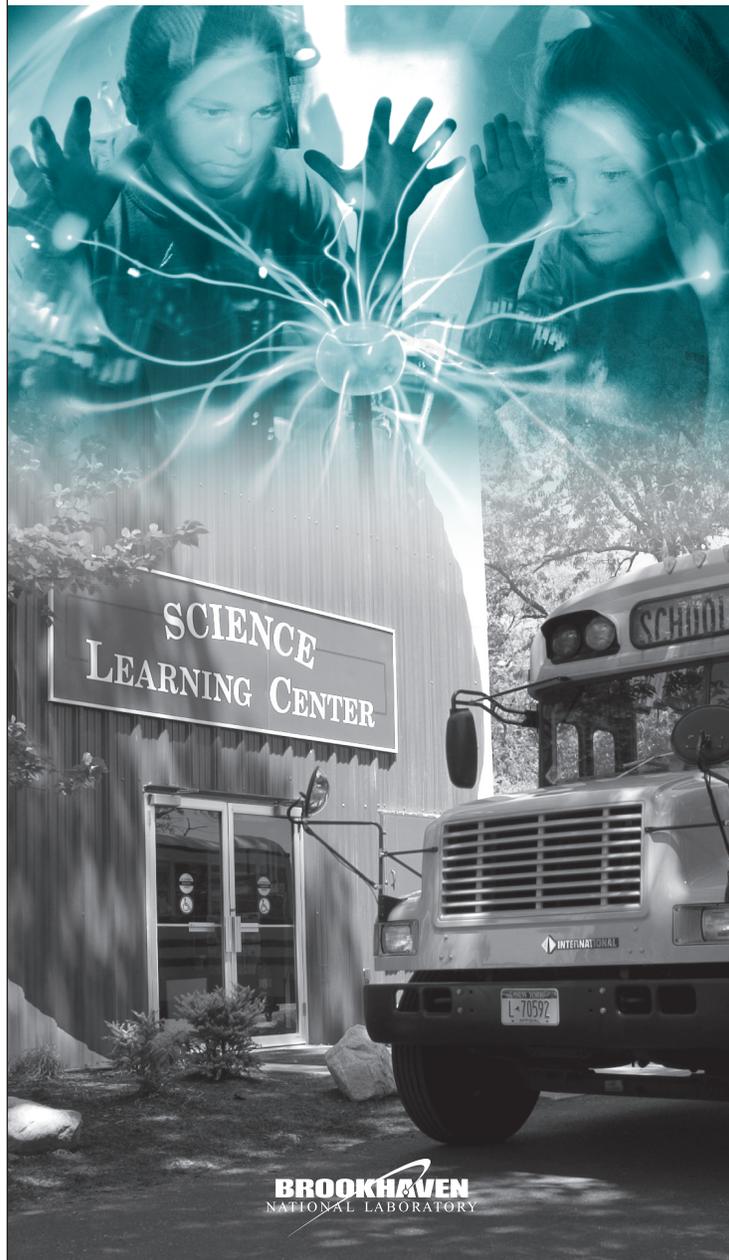


Brookhaven National Laboratory
Science Learning Center



Building the Science and Technology
Workforce of the Future

Discovery Activities



- Free programs for grades 1 through 8
- Minimum group size 15, maximum 30, up to 3 groups at a time
- Program length is 1.5 hours for grades 1-5
- Program length is 2 hours for grades 6-8
- Uses the inquiry method of teaching
- Exploration time with exhibits included
- Addresses New York State Math, Science & Technology Standards 1, 3, 4, and 5
- Compatible with National Science Education Content Standards A, B, C, D, and G

Science Learning Center Activities

Recommended for Grade:	1	2	3	4	5	6	7	8
Animal Tracking	✓	✓	✓	✓				
Blocks & Marbles	✓	✓	✓	✓				
Current Electricity			✓	✓	✓			
Design "Attractive" Structures				✓	✓	✓	✓	✓
Electromagnetic Spectrum						✓	✓	✓
Magnetic Levitation (Maglev)				✓	✓	✓	✓	✓
Magnifiers & Microscopes		✓	✓	✓				
Mars Experience						✓	✓	✓
Mars - Exploring the Red Planet				✓	✓	✓		
Measurement	✓	✓	✓	✓	✓			
Mini Magnets	✓	✓	✓	✓				
Mirror Magic		✓	✓	✓	✓			
Potential & Kinetic Energy			✓	✓	✓			
Relativistic Heavy Ion Collider						✓	✓	✓
Seeing the Light	✓	✓	✓					
Series & Parallel Circuits				✓	✓	✓		
Sounds Around	✓	✓	✓	✓				
Spectroscopy				✓	✓	✓	✓	✓
Static Electricity 101			✓	✓	✓	✓		
Static Electricity: An In-depth Program						✓	✓	✓
3D - The Third Dimension		✓	✓	✓	✓	✓	✓	✓
School Outreach: Magnets to Go			✓	✓	✓	✓		
Library Outreach: Discoveries to Go	✓	✓	✓	✓	✓			

Discovery Activities

Activity Descriptions

Animal Tracking: Every species of animal has its own tracks. Discover the unique characteristics. Emphasis will be placed on the wildlife at BNL.

Blocks and Marbles: Find a solution to an engineering problem.

Current Electricity: How is electricity generated? Create simple circuits and test materials for conductivity.

Designing "Attractive" Structures: Students use magnetic materials, geometry, and their own creativity to design and construct a structure that meets specific engineering criteria.

Electromagnetic Spectrum: An in-depth study of light and spectroscopy plus interactive experiences with UV light.

Magnetic Levitation (MagLev): Discover the history and science behind MagLev vehicles. Assemble and test a prototype car. Collect and analyze data.

Magnifiers and Microscopes: Concave and convex lenses – discover how a lens' shape can affect what we see.

Mars Experience: (2-hour program) Is life on Mars possible? Explore geology, maneuvering a rover, and test cells for exposure to cosmic rays.

Mars — Exploring the red planet: Students perform an investigation to discover similarities and differences between a Mars soil simulant and a sample of Earth's soil.

Measurement: Measure various materials using scientific tools. Evaluate the need for a standard unit of measure.

Mini Magnets: Determine which materials are magnetic. Explore invisible magnetic fields with a variety of natural and manufactured materials.

Mirror Magic: Experiment with a variety of reflective materials. Discover the result of combining mirrors and angles. Spend time in our mirror gallery.

Potential and Kinetic Energy: Develop an understanding of these two states of energy using a vehicle and ramp to overcome inertia. Collect, graph, and analyze data.

Relativistic Heavy Ion Collider (RHIC): Learn how scientists use BNL's particle accelerator as a microscope. Observe superconducting magnets at work using liquid nitrogen to change the properties of matter.

Seeing the Light: How is a rainbow made? An introduction to the principles of light.

Series and Parallel Circuits: Construct series and parallel circuits to determine which is used in your home.

Sounds Around: Discover how sound is produced and how it travels. Analyze how different pitches are produced. Experience sound waves as they pass through different types of matter.

Spectroscopy: Observe the diffraction process with different light sources. Understand how scientists identify elements by the light waves they produce.

Static Electricity 101: An introduction to the structure of the atom and how static electricity occurs. Enjoy a hair-raising experience!

Static Electricity: An In-Depth Program: Includes everything in Static Electricity 101 (above) and additional activities using the Periodic Table.

3D - The Third Dimension: How do we see depth in a flat object? Experience the Third Dimension in our 3D visualization theatre.

School Outreach Program to Suffolk County

Magnets to Go: Recommended for grades 4-6, this interactive program focuses on the discovery of magnetic properties and electromagnetism. Each program is one hour per class and available to Suffolk County elementary schools.

FEE
BASED

Summer Science Explorations at the Learning Center

- 3-day program – 3 hours per day
- Recommended for grades 4-6, up to 30 students
- Open to student groups enrolled in educational summer programs
- Inquiry-based activities on environmental and physical sciences
- Giveaways and snack included
- You provide transportation and teacher chaperone
- Fee is \$1,800 per class (group)

Library Outreach Program

Discoveries to Go: Recommended for grades 1-5, this one-hour interactive program focuses on the physical sciences. Available to Suffolk County libraries during the summer. Fee is \$250 per hour.

Exploration Labs



These programs for Middle and High School students addresses New York State Math, Science & Technology Standards 1, 3, 4, and 5 and are compatible with National Science Education Content Standards A, B, C, D, and G.

These fee-based labs are charged as follows:

Each program hour is \$225

1 hour lab \$225

2 hour lab \$450

3 hour lab \$675

An Outreach lab to your school is an additional charge of \$75 per day.

Scheduling a Program

- Call the Science Learning Center office at 631-344-4495
- Open by appointment, Monday through Friday
- Maximum class size is 30 students
- Rescheduling and Cancellations:
Programs may be rescheduled with no less than one week's notice. Cancellations may be made up to one week in advance with no charge. Cancellations made with less than one week's notice will be invoiced in full. Weather related cancellations will be rescheduled.

Other Programs and Contests

Students have the opportunity to participate in many additional educational programs sponsored by Brookhaven National Laboratory's Office of Educational Programs. Our contests, Open Space Stewardship Program, summer internships, and other activities have motivated and inspired our youth to better understand and appreciate science. These experiences might open the door to a career in science, engineering, or technology. In addition, the Laboratory offers professional development workshops for teachers. Please see our website www.bnl.gov/education for more details.

Exploration Labs

MIDDLE SCHOOL

Make Your Own Model Cell 1 hour (\$225)

All living organisms are made up of cells. In this session, students learn about different types of cells and use microscopes to see and observe real cells. Students then create a model cell based on their observations.

DNA Extraction 1 hour (\$225)

See real DNA — the molecule that carries the genetic blueprints for all living cells. Students will learn about the structure and nature of DNA as they extract and collect it from cell samples. This session will help students understand the basic concepts of molecules and the genetic code.

Gene Transfer and Genetic Engineering 1 hour (\$225)

Today, genes are “transferred” to create human insulin for diabetics and plants that are resistant to pests. In this session, students are introduced to the history of genetic transformation and how gene transfer technology continues to develop. Students then get hands-on experience transferring a gene that can make bacteria glow.

Protein Extraction and Purification 2 hours (\$450)

During this workshop, students will extract and purify jellyfish Green Fluorescent Protein (GFP) by hydrophobic interaction chromatography (HIC). Participants will learn how scientists use BNL's National Synchrotron Light Source to understand protein structure and function.

Virus! 1 hour (\$225)

Much of what is known about genetics comes from our understanding of viruses. Brookhaven Lab has contributed greatly to this knowledge through its work with the T7 virus, which today, is used in the biotechnology industry as a genetic “switch” for expressing proteins. In this lab, your students will infect a bacteria sample with T7 and then identify the infections in petri dishes. Using T7 as a model, students will also learn about different viruses such as HIV, influenza, and SARS.

A “Corny” Experience With Mendel's Law of Heredity 1 hour (\$225)

In this workshop, students will learn about Mendel's Laws, which explain how physical traits are passed down through genes, and use these laws to determine the traits of an ear of corn's unknown “parents.” Students will then learn about geneticist Reginald Punnett's tool, called the “Punnett Square,” to predict offspring genotypes and phenotypes from several crosses of corn. Students will also apply what they've learned to study their own inherited traits.

Protein Structural Biology in 3D 1 hour (\$225)

In this program, students will learn about the human genetic code and how scientists develop more effective medical treatments based on their knowledge of proteins. Students will examine DNA and protein structures using the same scientific databases as Brookhaven scientists. In our state-of-the-art 3D theater, students will also view and generate protein models to explore the relationship between protein structure and function.

Fun With Cosmic Rays - Making the Invisible Visible 1 hour (\$225)

Scientists use cloud chambers to see subatomic particles emitted during radioactive decay. Students will assemble cloud chambers, then observe and study particles by analyzing trails left by naturally occurring cosmic rays that regularly shower the Earth. As students discover that cosmic rays are all around them, they will be introduced to the world of particle physics, a Brookhaven Lab specialty.

BIOLOGY

PHYSICS

MIDDLE SCHOOL

A Piece of the Universe 1 hour (\$225)

Students will learn to estimate the size and scale of various bodies within our solar system. Your instructor will also explain how different telescopes are used to explore the universe while highlighting BNL's contribution to the Large Synoptic Survey Telescope, which will probe deep into our universe and provide new information about dark energy and dark matter.

Metal Removal by Zeolites - Boiling Stones 2 hours (\$450)

Zeolites are common minerals found in Earth's crust that play an important role in removing toxic metals and radioactive elements from wastewater. Brookhaven scientists are searching for new materials and techniques to enhance zeolites' ion-exchange reactions. This session begins with a review of atomic structure and the Periodic Table. Students will then perform an ion-exchange reaction experiment using calcium and iron ions to remove sample “contaminants.”

Nanotechnology - Tiny Things Bring Big Change 2 hours (\$450)

Scientists have discovered that materials at the nanoscale, measured in billionths of a meter, behave differently than at the macroscale. These differences open the door to new applications in areas such as energy conservation and self-assembling materials. Through hands-on activities, students will learn how properties differ at the nanoscale and explore opportunities that nanotechnology presents.

HIGH SCHOOL

DNA Analysis: Cutting DNA with Enzymes (AP Lab) 2 hours (\$450)

Cutting DNA from one molecule and pasting it in another is the basis of the “recombinant DNA revolution” and the rapidly expanding field of biotechnology. In this lab, your students will use the tools of recombinant DNA, called restriction enzymes, to analyze DNA and determine the identity of a bacterial virus.

Gene Transfer and Genetic Engineering 2 hours (\$450)

Today, genes are “transferred” to create human insulin for diabetics and plants that are resistant to pests. In this session, students are introduced to the history of genetic transformation and how gene transfer technology continues to develop. Students then get hands-on experience transferring a gene that can make bacteria glow.

The Citric Acid Process of Soil Remediation 2 hours (\$450)

Learn about a molecular technique developed at BNL for cleaning up toxic metals. Workshop participants follow a simple procedure to remove and recover a metallic “contaminant” by forming a soluble iron-citrate complex. Students will use the o-phenanthroline method to analyze the concentration of the iron in the soil.

Metal Removal by Zeolites - Boiling Stones 2 hours (\$450)

Zeolites are common minerals found in Earth's crust that play an important role in removing toxic metals and radioactive elements from wastewater. Brookhaven scientists are searching for new materials and techniques to enhance zeolites' ion-exchange reactions. This session begins with a review of atomic structure and the Periodic Table. Students will then perform an ion-exchange-reaction experiment using calcium and iron ions to remove sample “contaminants.”

Bridge Design 3 hours (\$675)

Participants will gain basic knowledge of engineering principals such as stress, column instability, and internal beam loading while working in teams to design and construct model bridges that are then are tested for strength. This workshop concludes with a discussion of lessons learned.

ASTRONOMY

CHEMISTRY

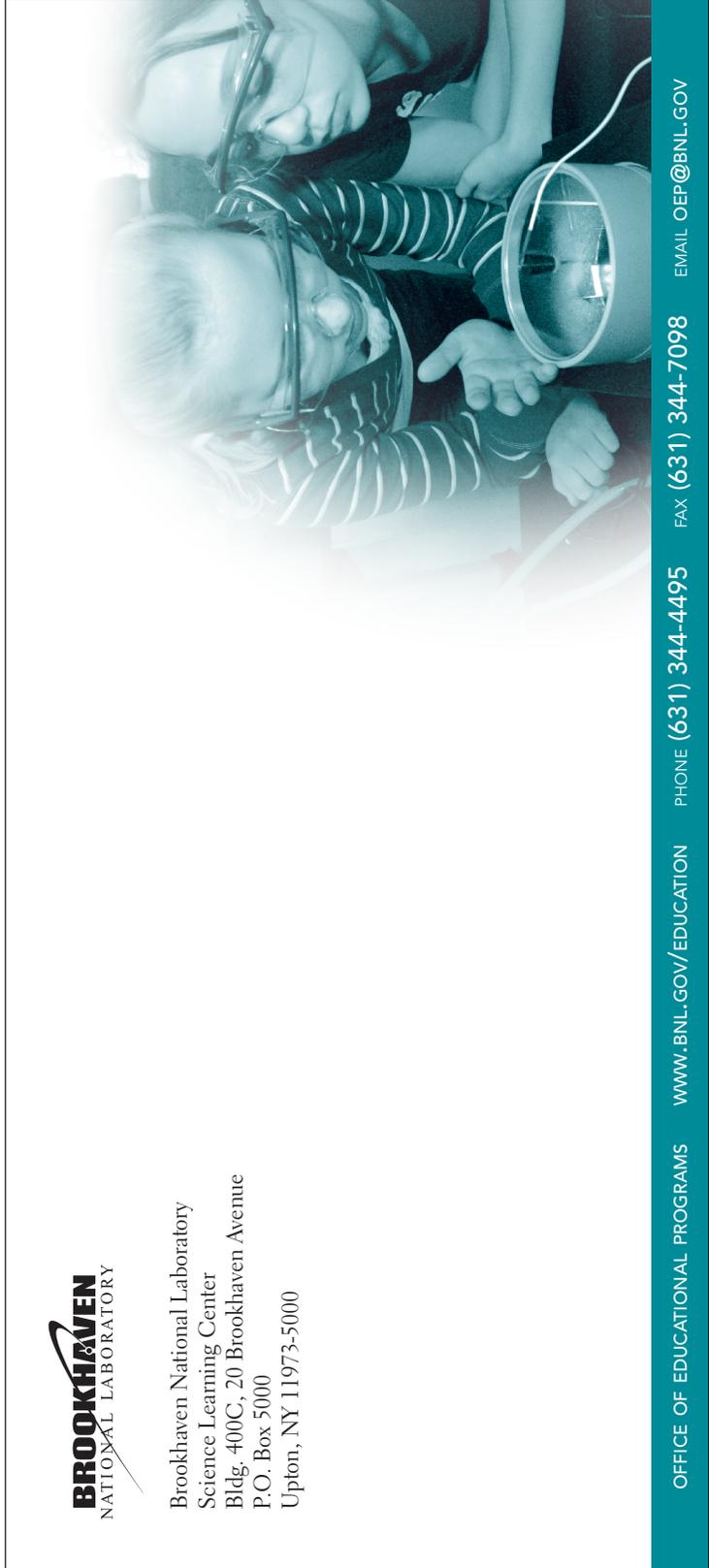
INTEGRATED SCI.

BIOLOGY

CHEMISTRY



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