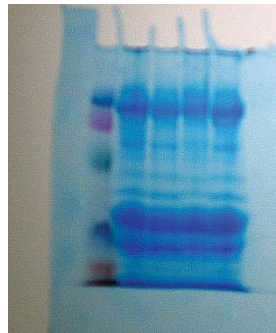


University of Rochester Medical Center

**LSLC**

Life Sciences Learning Center

**2009-2010**



<http://lifesciences.envmed.rochester.edu/>

## About The Life Sciences Learning Center

The Life Sciences Learning Center (LSLC), located at the University of Rochester Medical Center, is a unique hands-on science inquiry center for students in grades 6-12 from throughout the greater Rochester area. LSLC programs use hands-on and inquiry-based learning methods designed to boost science literacy and increase student enthusiasm towards learning science. The LSLC facility includes two teaching laboratories and is able to accommodate up to 48 students. The LSLC is part of the University of Rochester's Center for Science Education and Outreach.

LSLC programs include school-day field trips, both at the LSLC as well as in-school visits, summer and school vacation science camps, and workshops for science teachers. Over 2,000 students and science teachers attend LSLC programs each year. LSLC professional development programs and partnerships with science educators have brought our educational materials to teachers and their students throughout New York State and beyond.

## Our Programs

### Science Field Trip programs at a glance

Laboratory Activities: More detailed descriptions available in this brochure

Session Name	Length at LSLC	Length as In-School Field Trip	Bacterial Transformation	Cell culture	DNA extraction	DNA gel electrophoresis	Independent Investigation	Microscopy	Microbiology	PCR	Physical science	Protein gel electrophoresis	Restriction enzymes	Simulated Tests (Medical/Biotechnology)	Working with organisms
Bugs On Drugs	2.5 hrs	--													√
Cholera: An Evolving Pathogen	4 hrs	3 hrs						√	√					√	
Clinical Trials: Advancing the field	4 hrs	--					√	√							√
DNA Fingerprinting	4 hrs	--				√							√		
DNA: Hand Me Down Genes	2.5 hrs	80 min			√	√									
Environmental Explorations	2.5 hrs	--					√	√			√				√
Genetic Engineering	4 hrs	--	√			√							√		
Investigate Your Own DNA	4 hrs	--			√	√				√					
LSLC Crime Science Investigation	2.5 hrs	--				√		√			√				
LSLC Outbreak	2.5 hrs	--							√						
Molecular Evolution	4 hrs	--										√			
Medical Mystery: The Case of the Ailing Infant	4 hrs	3 hrs				√							√	√	
The Nervous System: Fixing a Broken Brain	4 hrs	--					√					√		√	
Stem Cell Biology: The Adventures of Cryptic Ron	4 hrs	3 hrs		√		√	√						√	√	

### School break programs

The LSLC offers school break programs through the Rochester Scholars Program. Our case-based programs guide students through real-life science and medical cases, and involve hands-on laboratory experiences.

### Teacher Workshops

The LSLC offers a selection of laboratory based workshops for teachers, however, it doesn't stop there! The LSLC staff have run personalized workshops on biotechnology, college level integration of math and biology and physical sciences. We specialize in developing hands-on solutions for your instructional needs. Please contact us to discuss your needs for professional development.

## Contact Information for Class Reservations

To register for our programs, or for more information:

Administrative Assistant: Amy Crosby

Amy\_Crosby@urmc.rochester.edu

Phone: (585) 275-0268

Fax: (585) 276-0238

# LIFE SCIENCES LEARNING CENTER

## 2.5 HOUR FIELD TRIPS

### 2.5 Hour Field Trip Programs

These laboratory investigations are designed for students accompanied by their teacher and are targeted towards students in grades 6-8, however students in grades 9-12 are welcome to sign up for these programs.

- Programs run from 9:30AM to 12:00PM
- Cost is \$12.00 per student

### DNA: Hand-me-down Genes

By examining a case study on a family with an inherited bone disorder, students will learn about the role that DNA and genes play in producing traits. Students analyze pedigrees and samples of "patient DNA" in order to gain an understanding of dominant and recessive genes, to learn about techniques that scientists use to examine DNA, and to practice using methods of predicting the probability that a trait will appear in future generations.

#### Laboratory techniques include:

- DNA extraction
- Gel electrophoresis

### Bugs on Drugs

How do you test the effects of drugs on an organism? Students will conduct their own experiments by studying the effects of nicotine, alcohol, epinephrine, and caffeine on heart rate in *Daphnia* (water fleas). Genetic influences of drugs' effects are also explored using a fruit fly mutant that lacks an enzyme for digesting alcohol.

#### Laboratory techniques include:

- Determine pulse rates in *Daphnia* (water fleas)
- Manipulate fruit flies in a controlled experiment

### Environmental Explorations

Students will investigate what pH is and how it affects water quality and viability of aquatic organisms. They will also learn how the pH of bodies of water can change due to human intervention.

#### Laboratory techniques include:

- Determination of pH
- Testing the effect of pH on *Daphnia*

### LSLC Outbreak!

Infectious disease is the number one cause of death world-wide. What is it, and how does it spread? Students will take on the role of epidemiologists and answer these questions as they track down the mysterious source of a mock epidemic. They will investigate disease diagnosis, treatment and prevention. They will also perform a hands-on experiment to learn about antibiotic resistance.

#### Laboratory techniques include:

- Graphing and analysis of data generated from an epidemic model
- Antibiotic sensitivity testing
- Determination of efficiency of washing for microbial removal

### LSLC Crime Scene Investigation

Students will play the role of CSI detectives as they investigate evidence from a mock crime. Hands-on activities will pull together a variety of laboratory standards including use of a compound light microscope and determining density. Students will also cover basic information about DNA as they use DNA Fingerprinting to solve the crime.

#### Laboratory techniques include:

- Use a compound light microscope
- Determine the density of materials by water displacement
- Gel electrophoresis
- Sound wave analysis



# LIFE SCIENCES LEARNING CENTER

## 4 HOUR FIELD TRIPS

### 4 Hour Field Trip Programs

These laboratory investigations are designed for groups of students accompanied by their teacher and are targeted towards students in grades 9-12.

- Programs run from 9:30AM to 1:30PM with a break for lunch (lunch is not provided)
- Cost varies for classes and are listed with each class

### Molecular Evolution

**Cost: \$18.00 per student**

Scientists compare proteins across species to determine evolutionary relationships, develop novel drugs, and understand population dynamics. In this class, students will extract proteins from fish and mollusk muscle. Gel electrophoresis will be used to compare the relative similarities and differences between the proteins found in the different species. Information from the gels can then be used to estimate evolutionary relationships between these samples.

#### Laboratory techniques include:

- Extraction of protein from animal tissue
- SDS-PAGE gel electrophoresis (protein gels)

### Medical Mystery:

#### The Case of the Ailing Infant

**Cost: \$15.00 per student**

A newborn infant is fighting for his life - how could his problem be diagnosed and treated? Students will take on the role of laboratory technicians as they perform different tests to diagnose what is actually a genetic disease. Students will learn about genetic testing and how changes in DNA lead to changes in the structure and function of proteins. Based on a real case, this unit provides a starting point for discussion on genetic diseases, genetic testing, gene therapy and bioethics.

#### Laboratory techniques include:

- Differential diagnosis: Testing for ammonia, glucose and drugs
- Paper chromatography
- Use of restriction enzymes in analysis of DNA
- Agarose gel electrophoresis

### Genetic Engineering

**Cost: \$15.00 per student**

Genetic Engineering describes the alteration of genetic material in a living organism. This procedure has many applications – from the design of gene therapy vectors to the production of proteins like insulin and growth hormones. In this session, students engage in a case study to learn how to engineer DNA to make an antibiotic resistant and helpful strain of bacteria.

#### Laboratory techniques include:

- Restriction enzyme digest
- Gel electrophoresis
- Ligation of DNA
- Bacterial transformation

### Investigate your own DNA

**Cost: \$18.00 per student**

Your DNA is 99.9% identical to any person you might meet today, but what does that other 0.1% look like? One kind of difference in the DNA from different people can be found in regions of DNA known as Variable Number Tandem Repeats (VNTR). In VNTR regions, different people have different lengths of DNA. In this class, students will isolate their own DNA and use the Polymerase Chain Reaction (PCR) to amplify a section of their DNA that contains a VNTR region. They will then compare the sizes of their VNTR regions with the rest of the class to see how likely it is that any one person shares the same length VNTR.

#### Laboratory techniques include:

- Isolation of student's own DNA from cheek cells
- Use of PCR (polymerase chain reaction) to amplify a region of each student's DNA
- Gel electrophoresis
- Data analysis using MS Excel

# LIFE SCIENCES LEARNING CENTER

## 4 HOUR FIELD TRIPS

### Cholera: An Evolving Pathogen

**Cost: \$15.00 per student**

In the 1830's Rochester, New York was the location of an outbreak of Asiatic Cholera, a disease that causes violent and often, in the absence of prompt treatment, fatal diarrhea. In the past 100 years, modern industrial nations have been largely free of cholera due to advanced water and sanitation systems. However, cholera continues to plague developing regions of Africa, Latin America and Asia. In the 1900's a new strain of cholera emerged, and persons who were exposed to cholera before and thought to be immune were again threatened by this new strain of bacteria. In this session, students engage in a case study that follows the emergence of this new strain of cholera, and the study of its evolution using microbiology and molecular genetic laboratory investigation. (Recommended for high school students only)

**Laboratory techniques include:**

- Gram staining and microscopy
- Simulated antibody agglutination assay
- Simulated DNA microarray

### Stem Cell Biology:

#### The Adventures of Cryptic Ron

**Cost: \$15.00 per student**

This humorous, but scientifically packed, case study introduces students to the characteristics of stem cells and their potential uses in learning about and treating diseases. Students will learn about research occurring at the University of Rochester Medical Center and use their knowledge to devise experiments to distinguish embryonic versus adult stem cells based on their potential for differentiation.

**Laboratory techniques include:**

- Isolation of plant stem cells using tissue culture techniques
- DNA fingerprinting using gel electrophoresis equipment
- Simulated cell differentiation activities
- Simulated DNA microarray

### DNA Fingerprinting

**Cost: \$15.00 per student**

Only 0.1% of your DNA sequence is different from any random person you might meet today. How are those differences detected? Students will learn about the technology used to see those differences in the context of solving a mock crime.

**Laboratory techniques include:**

- Gel electrophoresis
- Use of restriction enzymes in analysis of DNA
- Identification based on DNA technology

### The Nervous System: Fixing a Broken Brain

**Cost: \$15.00 per student**

Sara begins to lose her vision in the weeks following a serious car accident. Why is this happening and what can be done to help her? In this class, students will learn that visual perception involves neural pathways in the brain which can be "rewired" through visual rehabilitation. Students will then isolate and analyze proteins from simulated brain samples to learn about the molecular changes that are taking place during rehabilitation.

**Laboratory techniques include:**

- Protein preparation from tissue samples
- SDS-PAGE gel electrophoresis (protein gels)
- Paper chromatography

### Clinical Trials: Advancing the Field

**Cost: \$15.00 per student**

A patient arriving at the doctor's office is diagnosed with bradycardia (slow heart rate). A new drug treatment may help alleviate her symptoms but where did this drug come from? In this class students will learn about the heart as they record the effects of exercise on heart rate and perform a live electrocardiogram (ECG). Students will then simulate a phase I clinical trial of a new heart rate drug using water fleas.

**Laboratory techniques include:**

- Preparation of slides and use of compound microscope
- Setting up a controlled experiment
- Simulated antibody based assay

# LIFE SCIENCES LEARNING CENTER

## ON THE ROAD AND SCHOOL BREAK PROGRAMS

### LSLC On The Road

Can't make it to the LSLC? If you are within 30 miles of the LSLC, our staff can come to your school to lead the following classes: (Schools outside the 30 mile range should contact us for special arrangements)

Hand Me Down Genes.....	80 minutes	\$500 per session	\$300 for additional same-day sessions
Stem Cells: The Adventures of Cryptic Ron.....	3 hours	\$600 per session	\$300 for additional same-day session
Cholera: An Evolving Pathogen.....	3 hours	\$600 per session	\$300 for additional same-day session
Medical Mystery: Ailing Infant.....	3 hours	\$600 per session	\$300 for additional same-day session

### Student Science Camp Programs

LSLC camps are offered through the University of Rochester's Rochester Scholars Program. For details about registration, contact the Office of Pre-College Programs at the University of Rochester (585) 275-3221 or [precollege@rochester.edu](mailto:precollege@rochester.edu)

- Supervised 8:00-9:00AM drop off and 4:00-5:00PM pick up at the University of Rochester.
- Lunch time activities with other students in the Rochester Scholars Programs.
- Dormitory accommodations are available at an additional cost for summertime high school programs

### Summer Science Explorers: CSI

#### (Middle School)

In this one-week (full-day) program, students will play the role of CSI detectives as they investigate crimes in and out of the lab. They will learn a variety of techniques, including fingerprinting, DNA fingerprinting, microscopy, and testing of various biological and chemical samples. These skills and others will be put to the test as our team of investigators sort through the evidence to solve the crimes. (The activities presented here are similar to those in the 2008 CSI summer camp)

### Case Studies in Science: Medical Mysteries

#### (High School)

This course meets half-days (afternoons) for one week during February and April breaks, and two weeks in the summer. Each case study takes students through a problem-based learning process used by the University of Rochester Medical Center to teach medical students. In this course participants will learn how to examine DNA, perform laboratory based tests, identify microbes, and engage in a case that integrates legal aspects of health care.

### Case Studies in Science: Biological Research

#### (High School)

This course meets half-days (afternoons) for one week during February and April breaks, and two weeks in the summer. In this course, we explore problems and cases in biological research that will involve laboratory activities and techniques in molecular biology. Each case study examines a different field of biological research, from cancer cell biology to animal behavior. By the end of this course, students will have a better understanding of the research that happens at the University of Rochester Medical Center, as well as experience in designing experiments and carrying out common techniques in cell and molecular biology.

# LIFE SCIENCES LEARNING CENTER

## TEACHER PROFESSIONAL DEVELOPMENT

### Teacher Professional Development

LSLC professional development workshops are offered on a variety of topics and give educators experience with cutting-edge science technologies. These 5 hour hands-on workshops also provide teachers with innovative instructional materials that are aligned with New York State Math, Science and Technology (MST) standards, as well as National Science Education Standards.

- These five hour programs (including a 40 minute lunch break) can be scheduled at your school or the LSLC anytime between 8:00AM and 4:00PM (for example, from 9:00-2:00 or 8:00-1:00) on any weekday that is convenient for a group of teachers.
- Room requirements for each program are listed below.
- Workshops must be scheduled at least 4 weeks in advance.

### Electrophoresis

Principles of electrophoresis, both DNA and protein, are discussed. Methods for performing quick and easy electrophoresis activities with students using simulated DNA will be demonstrated, as well as methods for visualizing real DNA bands. We will also discuss case studies, both scientific and pop culture, that could be used to engage students in the use of electrophoresis. Teachers who have attended this workshop can borrow electrophoresis equipment for use in their classroom.

**Room Requirements:** At least 2 electrical outlets. Access to a sink is preferable.

### PowerPoint: Bringing Science to Life Through Animations

If a picture is worth a thousand words, how many words and ideas can you express in a movie? Use PowerPoint to its fullest potential by learning to create and present animations. Or challenge your students to create animations to express how they understand science around them.

**Room Requirements:** 1 computer per 2 teachers

### Math and Biology

Biologists do math too! Learn how math is used in biological studies, engage in student-friendly activities that require math to solve biological problems, and discuss ways of incorporating math into your own biology classroom.

**Room Requirements:** At least 2 electrical outlets. Access to a sink is preferable, but the sink does not have to be in the room in which the workshop is held.

### Polymerase Chain Reaction (PCR)

Would you like to do PCR with your students? If you have a PCR machine and you would like to walk through a commercially available kit with our staff, or if you are considering purchasing a PCR machine for your school and would like to demo a PCR machine, or if you would like to learn how to do PCR and borrow a PCR machine from the LSLC for classroom use, this workshop can be tailored to meet your needs. Thanks to a generous donation from Laboratory Products Sales Inc., a PCR machine is available for loan to schools whose teachers have attended an LSLC PCR workshop.

**Room Requirements:** At least 2 electrical outlets. Access to a sink is preferable. Please discuss with the LSLC staff what you would like to accomplish during the workshop at least 2 months in advance of your scheduled workshop date so that we can best meet your needs.

### Microscopy: Take A Closer Look...

Help your students become proficient microscopists using engaging activities. Understand the use of all the parts of a microscope and learn how microscopy is used in present day research. This session will also introduce teachers to "Scope on a Rope" (SOAR), a hand-held microscope with magnification up to 200x, developed by Louisiana State University. Teachers who have attended this workshop are eligible to borrow the SOAR for classroom use.

**Room Requirements:** 1 microscope per 2 teachers



# LIFE SCIENCES LEARNING CENTER

## TEACHER PROFESSIONAL DEVELOPMENT

### Alternative Energy

Are you interested in teaching your students about alternative energy? We can show you a collection of short activities and demonstrations that get students involved in learning the chemistry behind hydrogen fuel and solar cells, as well as understanding how electrical energy is converted into physical motion. Teachers who have attended this workshop are eligible to borrow 10 solar panels and one hydrogen fuel cell demonstration unit, as well as an alternative energy exploration kit.

**Room Requirements:** At least 1 electrical outlet. Access to a sink is preferable.

### Probeware

Learn how to use dissolved oxygen, temperature, pH and conductivity probes to assess water quality. Teachers who have attended this workshop are eligible to borrow 10 sets of Vernier probes for use in their classroom.

**Room Requirements:** One electrical outlet per team learning to use the probes. Access to a sink is preferable.

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**For more information about the LSLC's programs, contact us at**

(585) 275-0268

**or visit us on the web at**

<http://lifesciences.envmed.rochester.edu>