## LINCOLN LABORATORY EDUCATIONAL OUTREACH

S PART OF ITS RECENTLY launched community outreach initiatives, Lincoln Laboratory staff are delivering entertaining and educational presentations about science and technology to local schoolchildren. One element of this outreach-the Science on Saturday program-has had several successful events in recent months. In June, students and their parents filled the Lincoln Laboratory cafeteria to watch Paul Thomas of the MIT Plasma Science and Fusion Center present a series of demonstrations on the principles of magnetism and electricity. Thomas-an electrical engineer known as Mr. Magnet-began with fundamental concepts, and later applied these new ideas to applications of magnetism. There was plenty of opportunity for

Mr. Magnet—Paul Thomas of the MIT Plasma Science and Fusion Center intrigues local students with hands-on demonstrations exploring electricity. Here, in the Lincoln Laboratory cafeteria, he and two attendees test an iron wrench on a very strong magnet.

hands-on participation; students used the Van de Graaff generator, for example, to discharge electricity and create lightning-like displays.

In October 2006, Robert Haupt, a geophysicist with the Active Optical Systems group, explained the fundamental physics of sound and how the human ear captures and processes it. Haupt showed how to measure sound with lasers and how to make focused sound beams that only a few rows of the audience could hear at a time. His presentation, which included movie clips, cartoon characters, and secret messages, gave his young audience a chance to discover firsthand what happens to sound in a vacuum and to test how good their hearing was. The most popular demonstration electronically altered volunteers' voices to make young speaker sound older, older speakers sound younger, males sound like females, and females like males.

The last Science on Saturday event of the year, which took place in the Laboratory auditorium in early December 2006, was a chemistry magic show by Roder-



Students apply what they've learned about magnets to create a wreath out of paperclips.



Mr. Magnet and a volunteer demonstrate the Van de Graaff generator.



Robert Haupt from the Active Optical Systems group employs a variety of sound sources and sound measurement techniques in the Lincoln Laboratory auditorium. He discussed the physics of sound and hearing, and used parametric acoustic arrays to generate narrow beams of sound.

ick Kunz, a chemist in the Submicrometer Technology group. Kunz's chemistry show had 13 demonstrations, some of which were traditional color changes and small explosions that earn the moniker "magic show." But other activities more accurately typified what modern chemists do, such as solving a staged "crime" by audience members using trace chemical detection, and recreating an artificial flavor used in popular candy. Along with the focus on fun, the underlying theme of the demonstrations was the development of chemical intuition and the role it can play in learning chemistry.



In a demonstration of laser measurement of sound, lasers are used to record the voice from volunteers in the audience. Here, a student's voice causes the foil frame in front of him to vibrate. Then the vibrations are picked up by the onlooking laser across the room. When his conversation is played back after processing, it sounds just like him. The audience can even "hear" him whisper with the laser.





Todd Rider teaching sixth graders at Applewild School in Fitchburg, Mass., to identify and date different types of fossils. Left: A robot dog used in a school demonstration in Waltham, Mass.

In addition to putting on the Science on Saturday events, the Laboratory's Educational Outreach Program sends volunteer staff members to nearby school districts to talk about various science topics. In response to requests from teachers, Todd Rider, a biotechnology researcher of the Biosensor and Molecular Technologies group, visited about one school per week during the spring of 2006, giving presentations to more than 1300 students ranging from elementary through high school. For example, in one school he had students grow yogurt bacteria in sterilized milk and then test the effects of antibiotic ointment on the bacteria. In another school, he guided students through the process of identifying and dating a pile of fossils, including dinosaur tracks and mammoth ivory. He demonstrated thermodynamics and heat engines to students at a third school by using a drinking bird toy with a cold cup of water at its head and a hot cup of water under its tail. And in a fourth school, he introduced the basics of electric circuits with the help of a robot dog that chased flashlights.

Teachers are who interested in learning more about Lincoln Laboratory's educational outreach program should contact www.ll.mit.edu/Outreach/ EducationalOutreach.html, or Todd Rider at thor@ ll.mit.edu.