

HARVARD • CAMBRIDGE PUBLIC SCHOOLS

connections

partnerships for science education

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a message...

from **Michael A. Sullivan**, Mayor of the City of Cambridge,
and **Thomas Fowler-Finn**, Superintendent of Cambridge Public Schools

Cambridge Public School students are learning from the rich university environment that surrounds them. Young kindergarten students may not know until they are older just how lucky they are to have Harvard's renowned Museum of Natural History as a place for hands-on contact with the natural world, but as parents and educators, we are well aware of the many resources that Harvard brings to bear on student learning. As the school district expands its science curriculum (such as the new science research course at CRLS) and its commitment to science education, the new Science Initiative is reaching out to every student and every teacher in Cambridge to engage them in exceptional opportunities for in-depth science work.

Harvard University is key to helping us reach the goal of providing Cambridge Public School students with the best science education in the nation. Elementary, middle school and high school students, as well as our teachers, have benefited from museum and departmental resources, donated equipment, working directly with professors, teaching partnerships, and professional training that is unique to our district. We are grateful for the opportunities that connecting with Harvard provides. The stories on these pages show the variety of programs that students participate in, and an excitement for learning science that is in part derived from the enthusiastic effort that Harvard University has put into working with the Cambridge Public Schools.

from **Lawrence H. Summers**, President of Harvard University

Science is changing every aspect of the way we live. We all have a stake in promoting scientific literacy and in finding innovative solutions to pressing public problems.

At Harvard, we are proud to be partners with the Cambridge Public Schools to encourage the success of all of our students.



Jon Chase/Harvard News Office

Students Jordan Qualls and Yolanda Pierre reacted with wary fascination upon handling a sheep's liver during a Harvard science exploration program called Experi-Mentors, just one of many programs in which Harvard scientists and students encourage learning in Cambridge Public Schools.

Science partners: *Harvard graduate students support CRLS*

Holograms had always fascinated CRLS senior Andres Ojeda. He even tried to produce them years before, but it wasn't until he worked with Ari Turner, a Harvard graduate student in the Division of Engineering and Applied Sciences, that he mastered holograms, this time for his science fair project. Turner helped Ojeda understand the physics behind holograms and helped him get the equipment and resources he needed, including time in a physics lab at the Harvard Science Center, to successfully produce them. The result was an original science fair project – one that caught the attention of students, teachers and the Cambridge superintendent alike. It was just one of many project ideas that Harvard graduate students helped Cambridge Rindge and Latin School students with as they prepared for the school's annual science fair this year. Turner is one of 10 Harvard graduate students working two afternoons a week at the school to help teachers develop and implement educational activities that excite students about science and engineering.

“The GK-12 Fellows are an all-around resource to support physics teachers and students.”

– **Melanie Barron**,
CPS science
coordinator

The collaboration is supported by the National Science Foundation's GK-12 Program, whose aim is to enable graduate students in science, technology, engineering, and mathematics to enrich instruction in K-12



Rose Lincoln/Harvard News Office

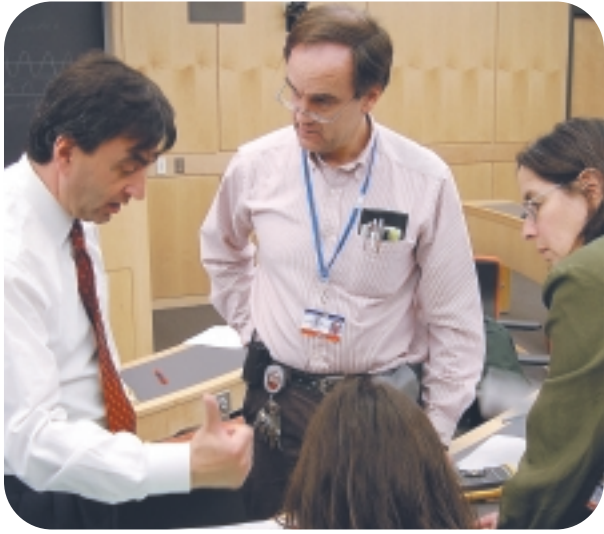
Senior Andres Ojeda (right) explained his science fair project involving holograms to Brian Murphy, one of 10 Harvard graduate students helping in Cambridge Rindge and Latin School classrooms.

schools while developing their own teaching skills. For graduate students, participation in the GK-12 Program is similar to having a teaching fellowship, both in the level of support and the responsibilities it entails. Each graduate student is paired with a CRLS teacher and must sign on for a one- to two-year commitment. By bringing young, enthusiastic role models into the schools, the program will, organizers believe, influence more youngsters to enter scientific and technical fields. “The GK-12 Fellows are an all-around resource to sup-

port physics teachers and students,” says Melanie Barron, coordinator for science in the Cambridge Public School District. “The Fellows and high school science teachers take time to make the right match between teaching and projects.”

“The graduate students benefit by explaining the research they’re doing to students who don’t yet have an extensive science background, and fielding some of the unexpected, yet fundamental questions that these students have,” says Kathryn Hollar, director of

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Eric Mazur (left), a Harvard physics professor, discussed a point with Cambridge Rindge and Latin teachers John Samp and Marian Levinstein.

Eliza Grinnell/DEAS Communications Office

Cambridge teachers take technology mini-course with Harvard physics professor

Semiconductors power computers, telephones and televisions. Solar cells are becoming increasingly important as the world seeks to make better use of cleaner, renewable energy sources.

Cambridge Rindge and Latin School (CRLS) science teachers received a mini-course covering the latest research about both technologies from Harvard professor Eric Mazur. In turn, the high school teachers are passing along their knowledge to their own students at CRLS.

Mazur and his team of faculty and graduate students shared the latest about semiconductors and photovoltaics — the science of converting sunlight into electricity — with enthusiastic participants like AP physics teacher John Samp.

“The seminar is a perfect opportunity for high school

and college teaching to intersect,” Samp said.

Mazur agreed. “The workshop was a great opportunity for me to put my own research in a broader perspective,” he said. “I am excited that some of it will reach the high school level.”

The seminar is one of several offered to local schools through the National Science Foundation-funded GK-12 program, which pairs Harvard graduate students from the Division of Engineering and Applied Sciences with Cambridge Public School District teachers to develop and share learning activities with Cambridge students. •

“A perfect opportunity for high school and college teaching to intersect.”

— John Samp, CRLS AP physics teacher

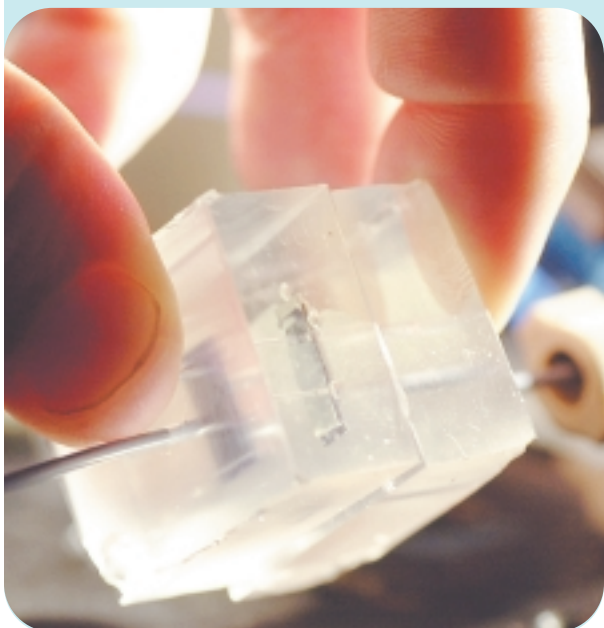
Cutting-edge science comes to the classroom

Cambridge Rindge and Latin School science teachers are receiving training from Harvard professors in nanoscale and mezoscale science, topics rarely taught in high schools, thanks to the Harvard-Cambridge GK-12 partnership.

The seminar series is jointly sponsored by the National Science Foundation-funded Materials Research Science & Engineering Center and the Nanoscale Science & Engineering Center based at Harvard University. The professional development is driven by the school’s interest in interdisciplinary science.

“By teaching our teachers about nanoscience, they can see the links between physics, chemistry and biology,” says Melanie Barron, K-12 coordinator for science curriculum at the Cambridge Public School District, who pointed to exciting new fields like bioinformatics, proteomics and protein-folding that approach science in an interdisciplinary way. “In the world of science research, there is no such thing as pure biology, pure chemistry, pure physics anymore ... but many high schools are still set up in a layer-cake way of doing science. Now we are teaching physics first, then chemistry, and then biology. Teachers are finding ways to link the disciplines to reflect the interdisciplinary nature of current science knowledge and research.”

“Science is developing at such a rapid pace now,” agreed Kathryn Hollar, director of educational programs for Harvard’s Division of Engineering and Applied Sciences. “The pace is so much greater and the discoveries are so exciting ... and high school teachers and students have a part in that.”



Jon Chase/Harvard News Office



First Family Science Night

Hundreds of Cambridge children and their parents explored science mysteries at the Harvard Museum of Natural History’s first-ever Cambridge Family Science Night on April 8. Luz Mary Escobar (at left) and her daughter, Pamela Restrepo, 5, peered at another world as Carolyn Lee, 7, and dad Ken Lee did likewise.

Kris Snibbe/Harvard News Office

Harvard microscopes advance CRLS science

When Harvard University donated microscopy equipment to Cambridge Rindge and Latin School, some of the science teachers weren’t sure how they could integrate the sophisticated laboratory into their teaching. Two years later, the lab is in full swing with teachers and students enthusiastically taking advantage of the high-powered microscopes, cameras, software and projectors that have encouraged original research, collaborative teaching and learning, and laid a foundation for inquiry-based science education.

The lab has helped students to take science into their own hands. One student, for example, was curious about the impact of drinking Gatorade and coffee. He was able to assess how much oxygen that potato cells used after they were treated with Gatorade, coffee, or a saline solution. The high quality of the microscopes and the supporting software allowed him to project images of the cells for the entire class.

“The student was able to photograph and display the experiment for his science fair project in such a way that a high school student before would never have been able to do,” says biology teacher Maureen Havern. “I’m delighted with the way in which teachers and students are using the lab.”

The equipment and technical support, which includes assistance from Harvard instructors and graduate students, were a gift of the Harvard University Department of Molecular and Cellular Biology (MCB), with additional funding from the Howard Hughes Medical Institute (HHMI).

“It came at a time when there has been a confluence of support and integration of Harvard resources into the public schools,” Havern says.

In addition to the microscopy suite, Harvard’s Department of Molecular and Cellular Biology is working to bridge a widening gap between cutting-edge research and teaching labs through a series of MCB-HHMI outreach programs for teachers and students. For the last three years, CRLS students and teachers have attended Harvard learning labs in polymerase



Kris Snibbe/Harvard News Office

CRLS biology teacher Tobe Stomberg (right) helped Sabienne Bernard learn to use new high-tech microscopes given to CRLS by Harvard University.

chain reactions and gel electrophoresis, how flies learn and remember, and the heart and the ECG, learning about specific topics while gaining valuable experience in a university laboratory.

New labs like investigating neuroscience using the *C. elegans* worm will premier this year. This spring, the Harvard-CRLS collaboration produced a new pilot lab, marine embryology, specifically for CRLS science teacher Paul McGinnis’ class.

“We really appreciate the effort that Harvard has been making during the past several years, and so do the students, whose interest in science is growing,” Havern says. “Our students are beginning to think that science is cool.” •

“Our students are beginning to think that science is cool.”

— Maureen Havern, CRLS biology teacher

Cambridge Public Schools Science Initiative strengthens Cambridge science literacy

The Cambridge Public School District has taken on the challenge of dramatically upgrading the teaching of science, but not just in the classroom.

“The district has set goals to integrate teaching science in schools with the community so that the entire city will demonstrate the characteristics of a scientifically literate community,” said Melanie Barron, CPS Science Curriculum head.

The Cambridge Science Initiative includes the following goals:

- To demonstrate the characteristics of a scientifically literate community through public lectures, discussions and events on areas of current research
- To offer an exemplary K-12 science curriculum that

reflects both national and state science education standards, funding teacher participation in national education conferences and providing updated science equipment to support higher standards for science instruction.

- To offer extraordinary opportunities to teachers and students to do additional in-depth science work. This includes teacher exchanges, such as this summer’s two-week teacher exchange for 12 Cambridge teachers on the Space Coast of Florida, April vacation “science” camps, and student and teacher participation in educational research missions.
- To foster partnerships between colleges and universities, the biotechnology industry, museums and companies to encourage excellence in science teaching and learning.

A head-start on science – and college



At last year’s Crimson Summer Academy, Crimson Scholar Chynah Tyler (left) of Roxbury watched Tenzin Dotsang of Cambridge Rindge and Latin pipette drops of liquid into a small vial as part of an experiment. Harvard President Lawrence H. Summers (below right) was among the teachers for the program.

Crimson Summer Academy helps talented students thrive

Twenty-one Cambridge students, 14 of them from Cambridge Rindge and Latin School, will take classes on Harvard’s campus this summer during the Crimson Summer Academy, Harvard’s academic enrichment program for talented, low-income youth. As Crimson Scholars, the students take part in a stimulating mix of science and technology, quantitative reasoning and writing classes, academic projects, field trips and extracurricular activities aimed at supporting their academic performance in high school and helping them prepare to become strong candidates for admission to a range of challenging four-year colleges and universities.



Widening teaching and learning for Cambridge teachers

More than 60 teachers and administrators in 12 of Cambridge’s 13 public schools are working with Harvard researchers to support the use of networked technology and advance curricular development in the Cambridge Public Schools.

Affiliated with Project Zero and Project WIDE (Widescale Interactive Development for Educators), the two-year grant-based initiative offers a core group of

teachers and administrators tuition-free access to online courses and the technical support needed to develop a proficiency in using technology in the classroom.

The project encourages project teams in each school to work together on curricular problems and solutions by using the Teaching for Understanding Framework, which guides planning, reflection and revision of instruction to focus on student understanding.

Science is...

Everywhere

“With much of the Cambridge economy based on developments in science, it is important to focus on integrating what is happening in research, business and in the universities in our K-12 school curriculum. By working together, we can help students and their families become engaged with the new developments in science that are literally surrounding them.”



Michael A. Sullivan, Cambridge Mayor

Teamwork



“This collaboration is about developing relationships that give our students immediate contact with powerful role models, many of whom are women and minorities, in the field of science. When you see the exchange in action, you can see the kind of impact that these relationships can have. Our students are getting the encouragement they need to go into the sciences and on to college.”

Dr. Sybil Knight,
Principal of Cambridge Rindge and Latin School

Evolving rapidly

“The frontiers for biology are expanding at a rate like we’ve never seen before, and there’s no question that our lives will be tremendously impacted by biology, even if we’re not physicians or research scientists. Making sure that science teaching has appropriate support in high school is even more important now than in the past.”

Dr. Robert Lue, Director of Undergraduate Studies in the Biological Sciences at Harvard



Fun!



“Science is everywhere; that’s what I’ve been learning in high school for the past three years. Do you like to solve problems? Do you like to dream up inventions? Do you like doing experiments? If you do, you like science. Science is pretty cool, and you can learn a lot of different kinds of things here at CRLS ... We do a lot of experimenting here, and it’s a lot of fun!”

Julia Berg, Junior CRLS

KUDOS! Congratulations to 11 outstanding CRLS students who were offered admission to the Harvard College Class of 2009. Seven more CRLS students have been invited to live on campus to attend the 2005 Crimson Summer Academy, joining seven who became part of the Summer Academy last year.

Test your science knowledge!

1. Whether mouse, mushroom, amoeba or marigold, if you are alive and breathing, you are considered an _____.

2. The study of the role of genes and proteins in health and disease is called _____.

3. What is the cellular stuff that makes you look like you do? _____

4. How many chromosomes do you have? _____

5. What is a genome? _____

6. How many base pairs of DNA are in a normal human genome? _____

7. What is the study and manipulation of materials at the atomic scale? _____

Harvard, CRLS partnership supports science learning



At the school's annual science fair, Andres Ojeda showed his project to Superintendent Thomas Fowler-Finn.

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educational programs for Harvard's Division of Engineering and Applied Sciences. "The GK-12 fellows develop a richer understanding of their chosen field, and often return to their research labs with a renewed curiosity."

Maureen Havern, a biology teacher at CRLS who serves as the school's liaison to the GK-12 project, believes that introducing graduate students into the school has helped students and teachers in a number of different ways.

"They have helped to knock down borders between the public schools and Harvard," Havern says. "They have helped teachers who work just a few blocks away to gain access to the Harvard labs, meet professors, and upgrade their own learning about their field. That's hugely important because it's so easy for high school teachers to be isolated in their own school. I've taught here a long time, and I can say that this program is making a huge difference. It's a true collaboration and partnership." •

"I can say that this program is making a huge difference."

— Maureen Havern, CRLS biology teacher

Kathryn Hollan/Division of Engineering and Applied Sciences

Harvard Museum of Natural History offers hands-on lessons for children

"Science is doing ... dreaming ... revealing. Science is touching ... exploring ... amazing. Science is seeing ... excitement ... testing..."

These words line the walls of the classroom at the Harvard Museum of Natural History and capture the scene underway. Today, kindergartners from the Baldwin School in Cambridge are experiencing what the earth was like millions of years ago.

Lisa Maloney from the museum's staff stands in front of the classroom and guides the students through time. Young fingers explore the ridges on the water-borne trilobite fossil that lived on the earth when it was mostly covered by ocean. Those same little fingers tentatively touch the trilobite's living ancestor, a horseshoe crab who has been gently lifted from its tank and introduced to each child. Next are dinosaur teeth, observed up close under a microscope and projected on a screen for discussion.

"Students get a unique perspective. They see things that they never would have seen any place else."

— Peg LeGendre, science mentor teacher for CPS

"A lot of things in museums sit in dusty nooks and crannies and there they stay," says Pete Money, education director for the Harvard Museum of Natural History. "But here we put resources from our 23 million specimens into the hands of children, whether that is actual dinosaur bones, minerals, or live animals, which is something our public schools can't do."

For the past three years, K-8 students from Cambridge and other area public schools have experienced science in three dimensions at the Harvard Museum of Natural History. The number of local students served has quadrupled since the programs began, and new programs are being added. Last year, nearly 2,000 students from all 12 Cambridge public elementary schools attended programs at the museum.

While field trips to museums are not unusual for elementary children, the Harvard museum's unique resources, and its partnership between the museum staff and public school teachers, set the Harvard Museum of Natural History programs apart.

"The reason why the science education programming is so successful is because it is a partnership," Money says. "We ask 'What can we do for you?' then develop programs that fill those needs."

The Harvard Museum of Natural History's hands-on science discoveries for children are specifically designed to complement what children are learning in area public schools. Topics include plant growth and development or "flower power," habitats and adaptations, exploring ecology, and rocks and minerals.

"It works to give us a terrific field trip and extends what we are learning in the classroom," said Peg LeGendre, science mentor teacher for Cambridge Public Schools. "Students get a unique perspective. They see things that they never would have seen any place else. They also see things in a larger context."

LeGendre adds that the core value is doing the science. "You're not just talking about it, you are doing it."

Money says Cambridge teachers are key. "How we do science education is distinctively different from what other museums do because of the teachers we work with," he says. "The teachers have been right there with us, testing pilot programs, so that we ultimately give them a product that they want and need."

"A lot of times a partnership is in name only, but this has been a real partnership," Money says.

In addition to "discovery" classes for K-5 students, the Harvard Museum of Natural History offers a range of labs and seminars that were developed in response to requests from the Cambridge Public Schools. These include a biodiversity lab for middle and high school students and mini workshops for teachers on a range of topics, such as mineralogy, paleontology, and biodiversity.

A new three-month teacher-training course called



Julie Russell/Harvard Community Affairs

Harvard Museum of Natural History teacher Lisa Maloney took Baldwin School kindergartners through time on a field trip packed with fossils, dinosaur bones and collections of stuffed animals. Working closely with the Cambridge Public Schools, museum education director Pete Money has developed programs for teachers and children of all ages.

"Life on Earth" premiered this year, as did a mentoring program that gives high school students experience and credit as natural history guides.

New programs for Cambridge youth groups launch in the fall. •

Summer study at CRLS: Students and teachers learn from each other

For Josh Bartholomew, teaching chemistry at the Cambridge Harvard Summer Academy was like coming home. After all, as a high school student at Cambridge Rindge and Latin School years before, he had discovered his interest in science.

Now, after years of working as an environmental engineer, Bartholomew was returning to his old school to teach science as part of an innovative partnership between the City of Cambridge and Harvard. Bartholomew is just one of many graduate students in the Harvard Graduate School of Education's Teacher Education Program who get real world experience in the classroom through the program.

Cambridge students, in turn, benefit by learning from enthusiastic young teachers who bring fresh perspectives

to the subjects they teach.

Nearly 400 Cambridge high school students sign up each year for the Cambridge Harvard Summer Academy, which is free and open to all Cambridge high-schoolers.

Last summer marked the program's fourth year. Most students come to make up credit for classes failed in the previous year. Others give up summer vacation to prepare for advanced placement.



"I try to be the kind of teacher I would want," said Josh Bartholomew about his experience as a teacher intern at CRLS.

Upon successful completion of the six-week intensive program, students gain credit for courses in English, social studies, math and science.

"When you understand something you like it more," said Betty Dorleans, CRLS sophomore, after the six-week academy last year. "I learned more in summer school than in regular school."

The experience is transformational, too, for the teacher interns, who work under the guidance of mentor teachers and use their experience toward gaining certification. For Bartholomew, being at CRLS fulfilled a dream. "I always knew I should have been a teacher," he said. "Great teachers can have a huge effect ... a real impact on students. I try to be the kind of teacher I would want." •

Tell us what you think! Email us at: ogcpa_feedback@harvard.edu.

