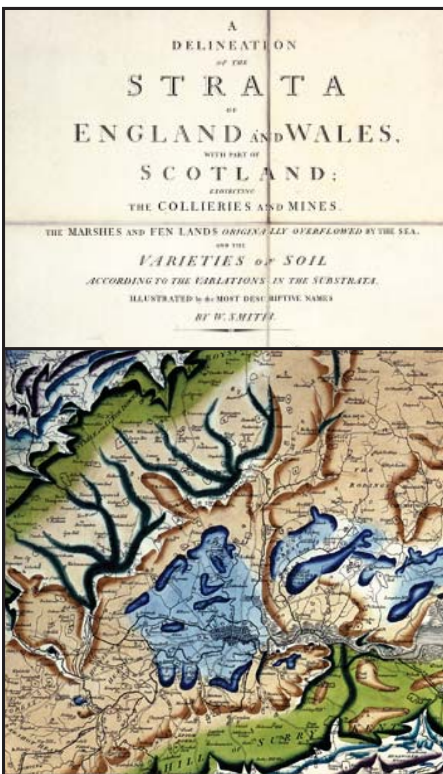




### EFFECTS OF ACID RAIN ON MICROORGANISMS IN LAKES

Researchers have long known that acid rain can severely decrease the diversity of plant and animal communities in lakes and ponds. However, little is known about how microscopic bacteria, which form the foundation of freshwater ecosystems, respond to acidification. To address this knowledge gap, researchers at RPI's Darrin Fresh Water Institute have developed one of the most comprehensive databases in existence on the impacts of acid rain on microorganisms. "Thanks in large part to the federal Clean Air Act and increased state focus on improving air quality here in New York, we are seeing a number of these lakes on a trajectory to recovery, but up until now we have had little understanding of the changing biodiversity of microbial communities within the impacted lakes as they recover," said Sandra Nierzwicki-Bauer, director of the Darrin Fresh Water Institute and professor of biology at Rensselaer. "I hope this study will help other scientists expand on the research and use this data to uncover additional information on how acid-impacted lakes and their ecosystems are recovering and how we can hasten that process."

More info → <http://news.rpi.edu/update.do?artcenterkey=2461>



### THE MAP THAT CHANGED THE WORLD

Dr. Gerald Friedman, Professor Emeritus of Sedimentology and Geohistory at Rensselaer, and his wife, Sue Friedman, recently donated three very special books to RPI. One of the books is quite rare and famous, written by William Smith, a founding father of modern geology, best known for his study of strata. The book is titled, *A Delineation of the Strata of England and Wales, with Part of Scotland*. Published in 1815, it is a beautiful hand colored map on 15 plates. Because of its rarity, few researchers have ever seen a copy. Roughly four hundred copies of the map were printed from 1815 to 1817, but only a dozen or so are still in existence today. There is one other known copy on display in a meeting room of the Geological Society of London, but most are in private collections. Since the book was originally painted in watercolor in the early 1800s, it must be stored carefully, as the colors would fade quickly under normal lighting conditions. Dr. Friedman's gift allows student and faculty researchers interested in geology a rare opportunity to view this historically-significant map. The map will be on display at Folsom Library during the fall semester. In honor of their generous donation, President Jackson presented Gerald and Sue Friedman with a Lifetime Membership in →



## THE MAP THAT CHANGED THE WORLD, CONTINUED

the distinguished Amos Eaton Society. There will be a formal presentation ceremony in late autumn or early spring.

Two other books were also donated by Gerald and Sue Friedman: *Abstract of a Dissertation Read in the Royal Society of Edinburgh Concerning the System of the Earth, Its Duration and Stability* by James Hutton, and a signed copy of Simon Winchester's recent best-seller, *The Map That Changed the World: William Smith and the Birth of Modern Geology*.

For questions about the Friedman's gifts, contact John Dojka, Institute Archivist.

## RPI HOSTS SUMMER SCIENCE CAMP

From June 15-17, a group of 50 middle school students participated in the ExxonMobil Bernard Harris Summer Science Camp at Rensselaer. The annual program provides students with an insider's look at careers within the world of science. Throughout the program, students conducted experiments, participated in hands-on projects and demonstrations, and attended classes and field excursions. The camps, which are free of charge, are offered to middle school students who are academically qualified, recommended by their teachers, and genuinely interested in math and science.

"There was incredible enthusiasm and interest from our campers, sparked by the connection between the exciting interactive experiments and field excursions and the core curriculum taught by our highly qualified and motivated teachers," said Cynthia Smith, assistant dean of students, director of pipeline initiatives and partnerships, and the director of the program at Rensselaer. "More than 220 students applied for the program's 50 spots."



Researchers in the Department of Earth and Environmental Sciences, including E. Bruce Watson, institute professor of science; two post-doctoral researchers, Jay Thomas and Jon Price; and doctoral student Ben Hallett, spent the day on Tuesday with the students at the science camp. They addressed two questions that often come up in scientific venues: *What is it made of?* and *How do we measure really small things?* "Recognizing that lecturing kids in grades five to seven isn't the best way to grab their attention, we introduced them to two important instruments of science: the electron microprobe to determine chemical composition and the atomic force microscope to create images of objects as small as a few atoms" Watson said.

Students also studied fresh water systems and ecological processes with researchers from Rensselaer's Darrin Fresh Water Institute and joined physics professor Douglas Whittet and physics graduate student Paul Mayeur to view the stars at Rensselaer's Hirsch Observatory.

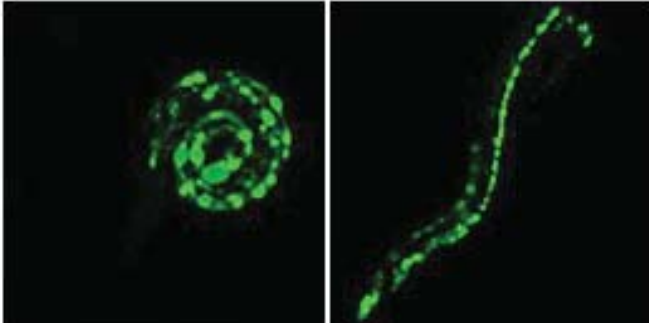
At the Hirsch Observatory, students were excited by the opportunity to observe Mars and Saturn, its ring system and large moon Titan, in the western twilight. The theme of this year's camp was "sustainability" and students were encouraged to consider the possibilities and prospects for developing a sustainable community somewhere outside of our home planet on a body such as Mars or Titan.

More info → [www.theharrisfoundation.org](http://www.theharrisfoundation.org)

# Inelegant Worms

## PROVIDE NEW CLUES ABOUT GENE REQUIRED FOR DEVELOPMENT

The normal nematodes in Fern Finger's lab move in beautiful S-shaped curves across their Petri dish. In fact, it was these elegant movements that gave the tiny, clear worms the Latin name *Caenorhabditis elegans*. But the dish also contains worms with a very specific genetic defect, a mutant *unc-85* gene, which are easily identified as the clumsiest dancers on the tiny dance floor.



The mutant worms, which are unable to move backward or even mate with one another despite valiant efforts, hold valuable information in their genetic makeup that could help scientists better understand the role of specific genes in both normal and abnormal development. While studying *unc-85*, Finger, a professor of biology at Rensselaer Polytechnic Institute, discovered that the gene significantly impacted DNA replication in the nervous system.

To make the discovery, Finger and RPI graduate Iwen Grigsby, Ph.D. '07 used a new variation of a specialized mapping technique to identify the genetic variation between the normal and mutant *unc-85* genes. Finger found that the *unc-85* gene encodes what is known as a histone chaperone protein – a protein that is essential for the packaging of DNA and the expression of different genes. The findings appear in the July 1, 2008 edition of the journal *Developmental Biology*.

When worms were raised with a mutant *unc-85* gene, the creation of new DNA strands is impaired during the last stages of development known the post-embryonic stage. Specifically, DNA replication in cells that produce neurons is blocked, creating the ungainly worms. Surprisingly, despite the presence of the genetic mutation, the worms still live to adulthood and are able to reproduce because they are hermaphrodites and can impregnate themselves.

To understand the role of *unc-85* in the worms, the researchers used a confocal microscope to measure the amount of DNA in the neurons. They found that the replication of DNA was affected in the *unc-85* mutants. To pinpoint what part of the body the mutant gene most directly impacts, worms were then developed that expressed *unc-85* fused to a protein that glows under the microscope wherever it is genetically expressed in the worm, as shown in the above image.

Under the microscope, *unc-85* was found throughout nearly every cell nucleus in the worm during the earliest stages of development, but as development progressed, the protein became restricted to cells that replicate DNA, primarily in the neuronal precursors and reproductive organs. "Since *unc-85* is so widely expressed in the organism at the start of the development, the limited extent of the mutant worms' outer symptoms are very surprising," Finger said.

Upon additional study, the researchers found that the gene encodes one of the two worm histone chaperone proteins known as Asf1. These genes are found in all fungi, plants and animals, including humans. Histone chaperones attach histones onto DNA and remove them from DNA. Histones are very small proteins that form into groups, making a sort of spool for a DNA strand to wrap around. The DNA/histone bundle is known as chromatin. This condensing of the DNA strand allows a massive strand of DNA to squeeze into a cell nucleus as it prepares for division and thus the sharing of the DNA. In addition, how tightly a gene sequence is spooled onto the DNA affects whether the DNA can be copied, which is important for duplicating the chromosome for cell division, and also for production of the protein encoded by the gene.

In the case of *unc-85*, the lack of this histone chaperone blocks DNA replication in cells that divide to produce neurons late in the development process. Finger is now looking to expand the research to better understand why and how the organism continues to undergo a certain level of normal cell division despite the genetic defect.

# RPI SCHOOL OF SCIENCE

## Honors and Awards



The Connected Kids system, built in cooperation between **Sibel Adali**, Associate Professor, Department of Computer Science; Professor Jim Zappen of RPI's Language, Literature, and Communication Department; and Professor Teresa Harrison of SUNY Albany, recently went live with an official kick off event (press release: <http://news.rpi.edu/update.do?artcenterkey=2436>). Connected Kids has been covered by the Times Union, Troy Record, Capital News 9, and WTEN. To visit the Connected Kids site, click here: <http://www.connectedkids.info>



**Kristin Bennett**, Professor, Department of Mathematical Sciences, gave an invited talk "Optimization and Machine Learning" in June at the IEEE World Congress on Computational Intelligence in Hong Kong.



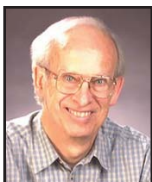
**Curt M. Breneman**, Professor, Department of Chemistry and Chemical Biology, Director of the Rensselaer Exploratory Center for Cheminformatics Research (RECCR), and his group are preparing to announce the establishment and funding of the Rensselaer Cheminformatics Consortium – an outgrowth of the NIH-funded RECCR – with Lockheed-Martin as the initial member. This also denotes a broadening of the scope of Cheminformatics work to include the emerging field of Materials Informatics on nanocomposites.



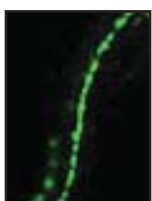
**Amanda Cook**, Graduate Student, Interdisciplinary Science, has been accepted into the Spitzer Visiting Fellowship Program for Graduate Students. She will spend six months at the Spitzer Science Center at Caltech, working on a research project closely related to her thesis research at RPI. Her research, under advisor **Douglas Whittet**, Professor, Department of Physics, Applied Physics and Astronomy, concerns the chemistry of ices in protoplanetary disks around newly born stars that provide analogies of conditions at the birth of our own sun and solar system. The Spitzer Space Telescope, named for pioneering Princeton astrophysicist Lyman Spitzer, is one of NASA's suite of "Great Observatories" designed to explore infrared radiation from space.



**Henry L. Ehrlich**, Professor Emeritus, Department of Biology, was recently published in *Geobiology* (vol. 6, no. 3, pp. 220-224). The article is titled "Are gram-positive bacteria capable of electron transfer across their cell wall without an externally available electron shuttle?"



**James P. Ferris**, Research Professor, Department of Chemistry and Chemical Biology, was cited on the History Channel program "How Life Began" that was broadcast several times during the week of June 16. The program cited Ferris's extensive origins of life research, one of his main research areas.



**Fern Finger**, Assistant Professor, Department of Biology, (see article "Inelegant Worms" p.3) spoke on June 10 at the University of Wisconsin, Madison at a symposium in honor of Professor John G. White, FRS. The talk was on "Septin functions in *C. elegans* axonal dynamics." White is the current Chair of the Laboratory of Molecular Biology and the James Crow Professor at UW-Madison. Finger was a postdoctoral fellow in Dr. White's laboratory from 2000 to 2003.



**Heidi Newberg**, Associate Professor, Department of Physics, Applied Physics, and Astronomy, gave an invited talk on June 5 at the Chinese Academy of Sciences in Beijing, China, titled "Making the Sloan Digital Sky Survey". The Sloan Digital Sky Survey will image 10,000 square degrees of the north galactic cap in five optical filters. Additionally, the project will obtain a million spectra of the galaxies detected in the imaging survey.



**George Plopper**, Associate Professor, Department of Biology, will be funded by the National Institute of Biomedical Imaging and Bioengineering to uncover the biological basis underlying functional differences in tissue structure. The work is based on a graph-theoretical method developed by **Bulent Yener**, Associate Professor, Department of Computer Science, that can model tissue structure and identify quantitative metrics capable of distinguishing healthy and diseased forms of the same tissue types (brain, breast, bone) with 87-99% accuracy. The project titled, "A computational tool for closing the gap between tissue structure and function," will run from July 1, 2008 to April 30, 2012.



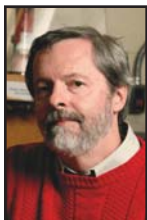
Rensselaer's Center for Initiatives in Pre-College Education, directed by **Lester Rubinfeld**, Professor, Department of Mathematical Sciences, recently received two grants for local inner city children. The first grant is for \$10,000 from the Bender Family Foundation, which will be used to support the development and implementation of a two week LEGO Robotics Engineering Academy this summer. The Academy will accommodate up to 25 children from the Trinity Institution and two charter schools in Albany. The other grant, joint with the Office of Diversity, is for \$8,250 from the Ronald MacDonald House Foundation, to purchase NXT LEGO Robotics kits for the Academy.



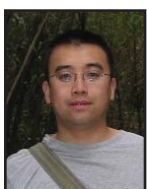
**Donald Schwendeman**, Professor, Department of Mathematical Sciences, recently hosted the Graduate Student Mathematical Modeling Camp. Thirty graduate students attended the program, which is designed to promote a broad range of problem-solving skills, including mathematical modeling and analysis, scientific computation, and critical assessment of solutions. More info: <http://eaton.math.rpi.edu/Faculty/Schwendeman/Workshop/GSMMCamp2008/information.html>



**Carlos Varela**, Associate Professor, Department of Computer Science, was invited to INAOE, Mexico in June as part of a monthly seminar series in celebration of 50 years of computing in Mexico and 10 years of INAOE's graduate program in Computer Science. His talk was titled "Towards a World-Wide Computer: Software Technology for Computational Grids." Varela also has been invited to the University of Tokyo (Professor Kenjiro Taura's research group) and to the University of Melbourne (Professor Rajkumar Buyya's research group) to continue his research on distributed programming models and tools, and computational science middleware. He will spend his sabbatical year from 2008 to 2009 at these institutions.



**E. Bruce Watson**, Institute Professor, Department of Earth and Environmental Sciences, and RPI graduate **Leslie Hayden**, recently had a paper published in *Proceedings of the National Academy of Sciences* (PNAS) about deep carbon in the Earth. The article, "Grain boundary mobility of carbon in Earth's mantle: A possible carbon flux from the core," describes new experimental results suggesting that carbon from a source deep inside the earth may migrate toward the surface over geologic time.



**Junfeng Xiao**, Graduate Student, Department of Chemistry, received an ASMS Student Travel Grant Award from the Northern New Jersey American Chemical Society Mass Spectrometry Discussion Group to attend the annual meeting of the American Society for Mass Spectrometry in Denver, CO, where he presented his paper "Genome Inspired G-quadruplex DNA Binding Ligands for Affinity MALDI-TOF Mass Spectrometry."



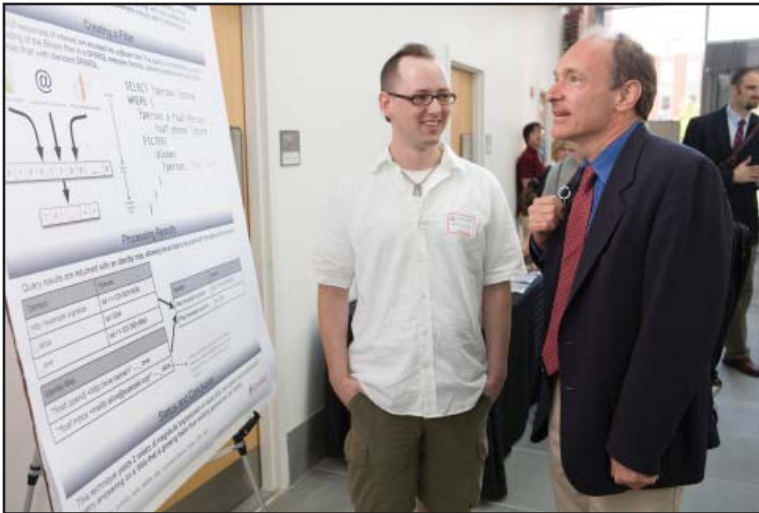
# Photos

## TETHERLESS WORLD CONSTELLATION

On June 11, 2008, leading authorities on the World Wide Web gathered at RPI for a public discussion about the future of the Web. The debate was part of a daylong event to celebrate the launch of the Tetherless World Constellation at Rensselaer, a new academic center devoted to the emerging field of Web Science. Participants in the event included Tim Berners-Lee, inventor of the Web and director of

the World Wide Web Consortium; Wendy Hall, vice president of the Association for Computing Machinery and senior vice president of the Royal Academy of Engineering; Nigel Shadbolt, former president of the British Computer Society and chief technology officer of Garlik; Nova Spivack, high-tech entrepreneur and founder of Radar Networks; and Tetherless World Constellation Professors James Hendler and Deborah McGuinness.

>>>Photos by Kris Qua.



This newsletter is prepared monthly and distributed to faculty, staff and students in the School of Science to keep everyone informed of accomplishments and events within the school. Please submit news items, including photos, for the next newsletter to [Rebekah Mullaney, Communications Specialist for the School of Science at mullar2@rpi.edu](mailto:Rebekah Mullaney, Communications Specialist for the School of Science at mullar2@rpi.edu).