

* * * RESEARCHERS CREATE SAFER ALTERNATIVE TO HEPARIN



Robert Linhardt has spent years stitching together minuscule carbohydrates to build a more pure and safer alternative to the commonly used and controversial blood thinner heparin. At the national conference of the American Chemical Society on August 17, Linhardt announced that his research team may have accomplished this task by building the first fully synthetic heparin. Their creation is the largest dose of heparin ever created in the lab.

Heparin is used around the globe and is among the most widely used drugs in American hospitals. The main source of this heparin is the intestines of foreign livestock, and the risk of contamination from such sources is high, according to Linhardt. As Linhardt and others around the globe worked toward an alternative, drug manufacturers worked to avoid contamination, but the risks proved too high.

In the spring of 2008, the search for a safer alternative to the common drug had reached a frantic pace after more than 80 people around the world died and hundreds became ill after they were administered what was believed to be contaminated batches of heparin from China.

Linhardt, Professor of Chemistry and Chemical Biology, and the Ann and John H. Broadbent Jr. '59 Senior Constellation Professor of Biocatalysis and Metabolic Engineering at Rensselaer, helped to identify the suspected contaminant in the Chinese heparin, a structurally similar carbohydrate called oversulfated chondroitin sulfate.

"When we found the contamination, it was another sign that the way we currently manufacture heparin is simply unsafe," he said. "Unlike the current heparin that is harvested from possibly disease-carrying animals in often very poor conditions, our fully synthetic heparin will be created in a pharmaceutical manufacturing environment from fermentation to packaging. This will give drug manufacturers extreme control over the safety and purity of the product."

Linhardt, together with Jian Liu of the University of North Carolina, discovered the synthetic "recipe" for heparin in 2006. Since that time, he has worked to piece together the various molecules and grow a complex carbohydrate that is naturally created in the body in the lab. The carbohydrate backbone for the new heparin comes from the bacteria *E. coli*. The use of the common and easily grown bacteria makes this version of heparin much easier and faster to produce, according to Linhardt. The team used a process called chemo-enzymatic synthesis that used specialized synthetic chemicals and natural enzymes expressed in *E. coli* to replicate the normal biosynthesis of natural heparin within the cell.

The dose that Linhardt and his team were able to produce with this method was a million times higher than any other alternative created to date. He will now continue to work with his partners to take the milligram dose that they have developed and expand it to kilograms. "Ultimately, drug companies are going to need to produce tons of this drug to keep up with global demand," he said. "Such levels of production are further down the road. We think that in five years, it is very possible that this drug could reach human clinical trials."

The milligram-scale synthesis of heparin will be published in the *Journal of the American Chemical Society*. To complete the research, Linhardt was joined by Zhenqing Zhang, Scott McCallum, and Jin Xie at Rensselaer; Lidia Nieto and Jesus Jimenez-Barbero at Centro de Investigaciones Biologicas; Francisco Corzana at Universidad de La Rioja UA-CSIC; and Miao Chen and Jian Liu at the University of North Carolina, Chapel Hill. He is currently working with Jonathan Dordick at Rensselaer, Jian Liu from Chapel Hill, and Shaker Mousa from Albany College of Pharmacy to create and evaluate the larger batches of the drug.

THE CLASS OF 2012: RENSSELAER WELCOMES FIRST-YEAR STUDENTS

The Class of 2012 at Rensselaer Polytechnic Institute promises to be an exceptional group, with an increase in average SAT scores and more than 65 percent of the students coming from the top 10 percent of their high school classes. The class comprises approximately 1,370 students. The high-achieving group includes nearly 400 women and a significant increase in the national and international profile of the student body.

The School of Science also has experienced a steady increase in the number of applicants and accepted students. This year, the School of Science welcomes an incoming class of approximately 360 first-year students. There were 310 first-year students in 2007, up from 286 in 2006.

In addition, Rensselaer has risen in its rankings among all national universities in the annual *U.S. News & World Report* list of "America's Best Colleges," weighing in at 41st, up from 44th last year. This is the ninth consecutive year that Rensselaer has been counted among the top 50 universities in the nation.



IT Master's Program & Computerworld Magazine



Eight years ago the first graduates of the master's program in information technology (IT) at Rensselaer entered the work force. Today, they work at some of the top Fortune 500 companies and bridge the important divide between the business and technical side of international companies. Now, the success of the program and its graduates has drawn the attention of one of the top IT publications, *Computerworld* magazine. The publication named the Rensselaer master's program in IT as one of its "IT Schools to Watch" in its August 18, 2008 edition.

The first publication to nationally recognize academic IT programs, *Computerworld* recognized Rensselaer for having "professors with industry experience, guest speakers from companies such as Morgan Stanley and the Reserve Bank of India, classes that emphasize skills like developing business cases, and a highly regarded capstone program, in which small teams of students complete an actual IT project for a client company."

Created in 2000, the interdisciplinary master's program in IT was among the first graduate-level IT programs in the world. A small and select group of students travel through the program together developing a well-rounded background in science, engineering, management, and social science. The program, founded by Vice President for Information Services and Technology, John Kolb '79 and Professor Greg Hughes '67, mixes hands-on programming with strategic business management.

The success of the graduates speaks for itself. Last year, 100 percent of the students seeking internships secured them with top companies and 100 percent of the program graduates were placed in jobs immediately following Commencement. The starting salary of that successful class was \$74,800, making it one of the most lucrative master's degrees that Rensselaer offers.

More and more students are looking to join the degree program, according to Gail Gere, director of program development. "There was a 30 percent increase in applications last year for a few select spots," Gere said. With only 25 new openings in the program of the upcoming class, Gere stresses that they are always working to strike a perfect balance between size, diversity, and quality. Total program enrollment for fall 2008 will likely exceed 40. The program, centered on problem solving, combines a strong foundation in computer science and technology with expertise in management and social issues. Because the program is completely interdisciplinary, students take classes in four of Rensselaer's schools and are given many opportunities to customize their degree program. Five core study areas are offered in strategic management of IT, networking, database design, software design, and human-computer interaction. In addition, each student then chooses one of eight different concentrations, which range from financial engineering to information security. **(continued on next page)**

Still in what could be considered its academic infancy at Rensselaer, the IT program already has proven that it will stay on the cutting edge. "We are constantly making sure that the program evolves with the marketplace," Gere said. "When a new field like financial engineering emerges, we will create new concentrations." Gere noted that the opposite is also true, with concentrations being retired as the rapidly expanding field of IT changes over time. "It is truly an amazing time to be graduating with this degree," she said. For the full *Computerworld* article, visit <http://tinyurl.com/68uedn>

RPI SCHOOL OF SCIENCE

honors - awards - travel - new faculty

News

Dr. Miriam (Mimi) Katz has accepted the position of Assistant Professor, Department of Earth and Environmental Sciences. She was previously a Visiting Assistant Professor at Rensselaer, as well as Assistant Research Professor at Rutgers University.

Dr. Katz is a micropaleontologist whose research focuses on Cenozoic foraminifera, marine protozoa often with carbonate shells, as keys to understanding global climate change and carbon cycling. She studies topics in the fields of paleoceanography, paleoclimatology, and biogeochemical cycles.



Her current research centers on high-resolution reconstructions of the major "greenhouse-to-icehouse" climate transition that occurred approximately 34 million years ago, with emphasis on understanding the causal relationships among system components of climate change, and reconstructing sea-level changes over the past 25 million years. In addition, she has a long-time interest in applications of micropaleontology to various topics, such as long-term changes in the geobiosphere and short-term ocean and climate forcing/response of ice sheet growth/decay, carbon cycle, and global climate change in the Cenozoic Era.

Dr. Katz received her B.S. from St. Lawrence University, M.S. from the University of South Carolina, and Ph.D. from Rutgers University, all in Geology. Her Ph.D. research focused on the extreme global warming event that occurred 55.5 million years ago, providing the opportunity to examine the causes of the event and the system response to climate change that occurred at rates similar to modern change.

"I'm excited to become a part of a dynamic department with motivated, enthusiastic students who are interested in undergraduate research," Dr. Katz said. "In addition to continuing with my ongoing research projects, I hope to expand into investigating the record of Holocene (past 10,000 years) climate change recorded in area lake and marsh sediments and microfossils, which will be ideal for student research participation."



This past summer, **Elizabeth Frank '09**, a senior in the Department of Earth and Environmental Sciences, worked with Dr. David Kring at the Lunar and Planetary Institute (LPI) in Houston, Texas. She researched the cooling rates of an impact melt breccia in a type-H chondritic meteorite that was recovered in Antarctica. Using a thin section of the meteorite, she performed petrographic analyses at the LPI and used the electron microprobe at NASA's Johnson Space Center to determine its chemical composition.



She was also given the opportunity to tour the Lunar Sample, Cosmic Dust, and Meteorite laboratories at Johnson Space Center, as well as the Mission Controls for the International Space Station, the Space Shuttle program, and historic Mission Control. "It was a great experience that has helped spur my interest in planetary science and has confirmed for me that it is the field in which I want to earn a Ph.D. after I graduate," she said.



Aric Mine '09, a senior in the Department of Earth and Environmental Sciences, had the opportunity to work with Dr. Dominic Papineau this past summer at the Carnegie Institution of Washington in Washington D.C. Mine's research focused on Banded Iron Formations (BIFs), specifically carbonaceous material and apatite in BIFs. BIFs are sedimentary rocks that form in an ocean environment enriched with iron from a source such as a hydrothermal vent. Oxide facies BIFs from Abitibi, Quebec of the Neoproterozoic period 2.8-2.5 Ga were the concentration of the study. The low metamorphosed state of Neoproterozoic BIFs from this area allows for the study of BIFs with minimal post-depositional alteration. An investigation of the carbonaceous

material in the BIFs from this region was performed to determine the occurrence of carbonaceous material and if its associated with apatite, which is a mineral that can form from the diagenetic maturation of organic remains. Mass spectrometry, laser Raman spectroscopy, scanning electron microscopy and optical microscopy were used to provide information about the origin and mode of occurrence of carbonaceous material. "Involvement in this project has piqued my interest in geochemistry which I will pursue further in graduate school in the fall," said Mine.



Rensselaer staff members were honored for their service and dedication at the **36th Annual Employee Service Recognition and Retirement Dinner**, held September 12 at the Desmond Hotel in Albany. Six members of the School of Science were honored for their years of service to Rensselaer: **Laurie Ahrens-Franklin** was recognized for five years of service; **Christine Coonrad**, **Dawnmarie Robens**, and **Jayne Taylor** were recognized for ten years of service; **George Edick** was recognized for 25 years of service; and **Elizabeth McGraw** was recognized for 35 years of service.



Dr. Lee Ligon, Assistant Professor of Biology, has been named a Public Information Committee Associate by the American Society for Cell Biology (ASCB). As a Public Information Committee Associate, Ligon will screen abstracts for the ASCB Annual Meeting, helping to select the most newsworthy research from 1200 to 1600 submitted abstracts. The research selected will be featured in the ASCB Press Book, provided to science journalists covering the meeting.



Jennifer Whiting, a senior Biology major, spent her summer as a participant in The Jackson Laboratory's Summer Student Program. Whiting was one of only 28 participants from around the country, selected from more than 400 applicants. Since its inception in 1924, 80% of the program's 2,200 plus alumni have gone on to successful careers in medicine or biomedical research, including Nobel Laureates David Baltimore and Howard Temin. Whiting worked with Scientific Curator Terry Maddatu, DVM on the Mouse Phenome Project. Whiting's project used bioinformatics and data mining techniques to identify genes associated with neuromuscular degeneration by correlating phenotypes with sequence differences in different inbred mouse strains.



Dr. Donna Bedard, Research Professor of Biology, presented her latest research in a talk in the "An Appetite for the Unusual" session of the Meeting of the International Society for Microbial Ecology in Cairns, Australia. The presentation "Dehalococcoides strain CBDB1 extensively dechlorinates the commercial polychlorinated biphenyl (PCB) mixture Aroclor 1260" describes the first pure strain that can dechlorinate and detoxify a complex commercial PCB mixture.



The work of RPI Biology alumna **Dr. Claire Fraser-Liggett** on the anthrax genome was the subject of an August 21 article in the *New York Times*. Fraser-Liggett was the former director of The Institute for Genomic Research (TIGR), and her team decoded the genomes of the strains used in the 2001 anthrax attacks and compared them to other sequenced anthrax genomes. The findings of the TIGR team were instrumental in identifying the laboratory of Dr. Bruce Ivins as the source of the strains used in the attacks. Dr. Fraser-Liggett is currently the Director of the Institute of Genome Sciences at the University of Maryland School of Medicine. To read the full article, visit www.nytimes.com/2008/08/21/science/21anthrax.html



Dr. Michael Shur, Patricia W. and C. Sheldon Roberts Professor (ECSE and Physics), served as General Chair of the Lester Eastman Conference on Advanced Semiconductor Devices. The conference was held at the University of Delaware from August 4 - 8. Professor Shur also chaired the plenary session and gave an invited talk.

Dr. Paul Stoler, Professor of Physics, was named Chair of the CLAS12 Steering Committee. This is a committee of the CLAS Collaboration of the Thomas Jefferson National Accelerator Facility (Jefferson Lab). Jefferson Lab is undergoing a \$300 million energy upgrade. The CLAS12 Committee is facilitating and guiding the CLAS Collaboration toward building the new detector equipment, and defining the nuclear/particle physics program for the new facility. The CLAS Collaboration consists of about 200 members representing major universities and national laboratories in the U.S. and all over the world including France, Italy, Germany, United Kingdom, Russia, Korea, Chile, and Armenia.



Dr. Heidi Newberg, Associate Professor in the Department of Physics, Applied Physics, and Astronomy, gave an invited review talk at the Sloan Digital Sky Survey Asteroids to Cosmology Symposium on August 16 in Chicago. Her work was mentioned in two of the press releases from the meeting, which were carried on internet news services around the world: http://www.sdss.org/news/releases/20080815.mission_final.html and http://www.sdss.org/news/releases/20080816.segue_final.html. Professor Newberg and graduate student **Nathan Cole** were also quoted in the USA Today article "Milky Way's halo loaded with star streams" http://www.usatoday.com/tech/science/space/2008-08-18-milky-way-star-streams_N.htm?csp=34



Dr. Toh-Ming Lu, R.P. Baker Distinguished Professor of Physics; **Dr. Gwo-Ching Wang**, Department Head; and **Dr. Fu Tang**, Postdoctoral Research Associate (Physics, Applied Physics and Astronomy) gave an invited talk at the SPIE

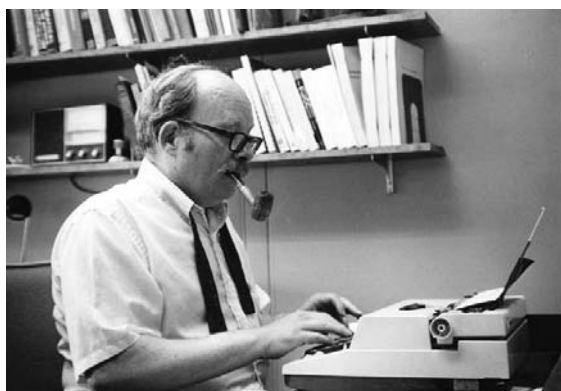
Optics+Photonics 2008 conference in San Diego, CA in mid-August. The talk was titled: "Shadowing growth of biaxially oriented nanostructured films." After the conference, they received an invitation from the Commissioning Editor of SPIE Newsroom to write an article for SPIE. SPIE has a large community of members who are involved with nanotechnology. The article is titled, "A surface pole figure technique for monitoring growth front texture." The research team submitted the article to SPIE and expect it to be published at <http://spie.org/> in the next few weeks. To learn more about the Optics+Photonics conference, visit <http://spie.org/optics-photonics.xml>

* Over 40 School of Science students attended the **Navigating Rensselaer & Beyond Incoming Student Luncheon** on August 22. Department of Physics, Applied Physics and Astronomy faculty and members of the student-organized Society of Physics Students (SPS) talked about upcoming events, free peer tutoring in Physics and Math, undergraduate awards, professional societies to celebrate undergraduate achievement, and cutting edge undergraduate research opportunities. The department also hosted a **Physics Graduate Student Welcome Event** on August 19 for incoming graduate students. **Dr. Gwo-Ching Wang** presented a brief overview of the department, **Dr. Paul Stoler**, head of the graduate program committee, explained specific departmental requirements, and **Nicole McQuade**, graduate coordinator, presented basic departmental and campus resources available to students and important deadlines. **Dr. Peter Persans**, associate department head, discussed the departmental TA orientation and what is expected of TAs. The meeting was followed by lunch for faculty and students.

Dr. James Ferris, Research Professor, and **Dr. Michael Aldersley**, Assistant Clinical Professor, Department of Chemistry and Chemical Biology, participated in the International Society for the Study of the Origin of Life (ISSOL) 15th International Conference in Florence, Italy from August 24 - 29. Professor Ferris delivered a lecture and presented his research group's poster, entitled "RNA Synthesis by Mineral Catalysis." The group includes Ferris and Aldersley, Post-Doctoral Research Associate **Dr. Prakash Joshi**, and John Delano of the University at Albany. To learn more about the event, visit <http://www.dbag.unifi.it/issol2008/>



Dr. Chjan Lim, Professor of Mathematical Sciences, gave a talk at Nanyang Technological University in Singapore on August 7, 2008. The talk was entitled "Computational Math/Physics on Desktops Can Now Resolve Hard Open Problems in Planetary Atmospheres." Several open problems regarding the super-rotation of Venus's atmosphere and the structure and persistence of Jupiter's Great Red Spot (14000 km across) – in particular the high velocity of 100 m/s in its circumferential band of 3000 km width as observed by Voyagers 1 and 2 – were partially resolved using advanced Monte-Carlo simulations on desktops of Dr. Lim's recent unified statistical theory of shallow water flows on a rotating sphere. The talk emphasized open mathematical problems connected with the existence of constrained minimizers for the Lagrangian of the flow and their relation to the minimizers of the free energy of the statistical theory.



Dr. George Handelman, mathematician and former Dean of Science, died this past Saturday, September 13. After earning his bachelor's and master's degrees from Harvard, and a doctorate in applied mathematics from Brown, Dr. Handelman came to Rensselaer in 1955 as Professor of Applied Mathematics. From 1972 to 1978, he served as Dean of the School of Science, and was later appointed our first Amos Eaton Professor. He retired in 1990 and continued on as a Professor Emeritus. His publications include more than 60 articles on diverse topics such as stability of structures, acoustic and elastic wave propagations, vibrations of structures, and mathematical models in biology. Dr. Handelman helped to institute the first undergraduate degree program in mathematics at RPI in 1959, and develop the applied mathematics program. He was instrumental in obtaining funding for the renovation of Amos Eaton Hall and for the first large-scale computer at Rensselaer, as well as establishing the Einstein Chair. In addition to his many undergraduate students, he mentored numerous Ph.D. students who went on to become leading mathematicians at universities throughout the country. In recognition of his dedication and commitment to the students at Rensselaer, he was awarded both the William H. Wiley Distinguished Faculty Award and the David M. Darrin Counseling Award. In a letter to Rensselaer's president in 1990, Dr. Handelman described the fulfillment he felt looking back on his years at RPI. Of greatest importance was the opportunity to work with the talented faculty at RPI and "the pleasure of knowing, teaching, and advising an amazing host of students. The opportunity to watch, and even help them grow as scholars and human beings is, I feel, the real reward of that special occupation, a teacher. They have indeed made my life worthwhile."



In an opinion piece titled "The first modern cyberwar?" published in *The Guardian*, Tetherless World Senior Constellation Professor **James Hendler** and University of Maryland Professor Aaron Mannes suggest that Russian attacks on Georgian websites were only a sideshow to the main conflict, but highlight a major threat to the internet. Read the full commentary at <http://www.guardian.co.uk/commentisfree/2008/aug/22/russia.georgia1>

Tetherless World Senior Constellation Professor **Deborah McGuinness** has been appointed to the scientific advisory board of the University College Cork's Environmental Research Institute's new European Union-funded project on Information and Communication Technology for Sustainable and Optimised Building Operation. This is a 6.2 million euro project that aims to use emerging technology to jumpstart next generation sustainable technology. Professor McGuinness gave a keynote speech at the opening meeting on trends in semantic technologies in Cork, Ireland on September 2, 2008. For more info, visit the UCC ERI website: <http://www.ucc.ie/en/ERI/>



UPCOMING EVENTS

RPI CS DAY :: DATA MINING AND MACHINE LEARNING

Date: September 22, 2008 - Time: 9:20 a.m. - Location: Biotech Auditorium

Speakers: Christos Faloutsos, Computer Science, Carnegie Mellon University; Usama M. Fayyad, Chief Data Officer and Executive Vice President, Yahoo Inc.; Michael Kearns, Computer and Information Science, University of Pennsylvania; Tomaso A. Poggio, Computer Science and Artificial Intelligence Laboratory, MIT.

For more info, visit ---> <http://www.cs.rpi.edu/news/rpicsday/index.html>

NAVIGATING BEYOND RENSSELAER

Date: October 15, 2008 - Time: 3 - 7 p.m., followed by dinner - Location: Biotech Auditorium

Navigating Beyond Rensselaer is designed to give graduate students in the School of Science a feel for professional life after graduating and how to prepare for it. The event will include a proposal writing workshop, a keynote speaker on the theme of life post-graduation, and a panel of speakers from mixed (industrial and academic) backgrounds, to share their experiences and insight. A certificate of participation will be provided to students who complete the 80-minute workshop. The entire event, including refreshments and dinner, will be provided at no cost to School of Science graduate students who register for the event. For more info, contact Sanchay Subhedar (subhes@rpi.edu) or Scott LeFevre (lefevs@rpi.edu).

* 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.