Pitt Chronicle

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Ezra T. Newman Receives 2011 Einstein Prize For Contributions to Understanding, Reshaping Einstein's Theory of General Relativity

R. SCHULTE-LADBECK

Ezra T. Newman

By Morgan Kelly

During his 60 years in general relativity, the field of physics established by Albert Einstein, University of Pittsburgh professor emeritus of physics and astronomy Ezra T. Newman not only worked alongside some of Einstein's closest colleagues to revitalize the theory of general relativity, he also helped to reshape it by working out one of the most influential reformulations of the revered scientist's original theory, among other lasting solutions to and insights concerning the Einstein equations.

To recognize Newman's lifetime of work at the forefront of general relativity, the American Physical Society has awarded him the 2011 Einstein Prize for his part in devising the renowned Newman-Penrose formalism—an extension of Einstein's theory of general relativity—as well as for composing a variety of solutions to Einstein's equations, particularly the Kerr-Newman black hole. The prize also commends Newman's ongoing work to explain the significance of far-flung light energy.

Continued on page 2

Pitt Launches New Society For Planned-Giving Donors Of $1 Million or More

By Susan Zavage Grivnow

The University of Pittsburgh launched its newly established Brackenridge Circle—comprising individuals whose planned gifts, pledges, and other contributions to the University total $1 million or more—with a Nov. 3 awards ceremony for the inaugural class of Brackenridge Circle donors in the Hall of Sculpture at the Carnegie Museum of Art.

Planned gifts are made by individuals who have included the University in their estate plans through bequest pledges, by naming the University as a beneficiary in a life insurance policy, or by establishing charitable trusts and gift annuities. Seventeen members of the Brackenridge Circle were in attendance for the inaugural celebration. Once realized, the gifts of the more than 65 living donors who qualify for inclusion in the Brackenridge Circle will total more than $88 million for the University.

> The Brackenridge Circle was named for Pitt founder Hugh Henry Brackenridge, who envisioned a great seat of learning west of the Alleghenies and secured Commonwealth financial support for the establishment of the Pittsburgh Academy, the progenitor of today's University of Pittsburgh.

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Welcoming remarks for the evening were given by Pitt trustee Sam Zacharias (A&S '64), chair of the Institutional Advancement Committee of the University's Board of Trustees, which oversees Pitt's $2 billion Building Our Future Together fundraising campaign.

"So much of what we do at the University of Pittsburgh is made possible by the generosity of our alumni and friends who make charitable contributions to Pitt," Zacharias said. "Private support from people like you, at all levels, is making a difference and is helping to continue Pitt's legacy of excellence in education and research."

Pitt Vice Chancellor for Institutional Advancement Albert J. Novak Jr. said to the inductees, "Your generosity inspires all who live, work, and study here, past, present, and future."

During the event, each inductee was honored separately and presented with a gift symbolic of the University's gratitude.

In his closing remarks, Clyde B. Jones III, Pitt vice chancellor for health sciences development, said, "I am moved knowing that you believe in what we are doing and are investing in the future of the University of Pittsburgh and in the futures of everyone it serves. On behalf of the University of Pittsburgh, you have our deepest respect and gratitude—and our pledge to be good stewards of your gifts."

For more information on planned giving at Pitt, or to make a gift, visit www.giveto.pitt.edu or call 1-800-817-8943.

Following is a list of the inductees who were honored at the event.

• Carole A. Baierl and the late William

Continued on page 2

Pitt Alumnus Terrance Hayes Wins National Book Award for Poetry

By Patricia Lomando White

University of Pittsburgh alumnus Terrance Hayes has been named a 2010 National Book Award winner for *Lighthead* (Penguin, 2010), his fourth collection of poetry.

A description of the book on the National Book Foundation Web site reads, "In his fourth collection, Terrance Hayes investigates how we construct experience. With one foot firmly grounded in the everyday and the other hovering in the air, his poems braid dream and reality into a poetry that is both dark and buoyant. ... This innovative collection presents the lightheadedness of a mind trying to pull against gravity and time. Fueled by an imagination that enlightens, delights, and ignites, *Lighthead* leaves us illuminated and scorched."

Terrance Hayes

Patricia E. Beeson, Pitt provost and senior vice chancellor, said "The University's graduate programs in English are known for a long tradition of innovative leadership in their respective areas, including creative writing. I am delighted that the strength of the MFA program is being recognized again through this well-deserved acknowledgement of Terrance Hayes' work."

A professor of English at Carnegie Mellon University, Hayes earned a BA from Coker College in Hartsville, S.C., and an MFA in writing from Pitt in 1987.

"It's so wonderful for him, the University, and the city. It's a national recognition that says a lot about Pitt's MFA program," said poet Toi Derricotte, Pitt award-winning professor of English who served on Hayes' MFA committee. "He has always been a person determined to be a really great writer, and our MFA program is a place where you can learn to do that. We have a diverse group of professors, which enables writers like Terrance to try different kinds of work. He is a poet who takes risks."

According to Derricotte, Hayes was involved in a social and very rigorous community of poets and instructors while at Pitt. He was instrumental in bringing students together with other poets in the city. He also served as Derricotte's graduate assistant and the first staff person for Cave Canem, a nationwide fellowship founded in 1996 by Derricotte and poet Cornelius Eady that cultivates the artistic and professional growth of African American poets.

Hayes' other books of poetry are *Wind in a Box* (Penguin, 2006), which was named one of the best 100 books of 2006 by *Publishers Weekly*; *Hip Logic* (Penguin, 2002), winner of the 2001 National Poetry Series Open Competition and a finalist for the *Los Angeles Times* Book Award; and *Muscular Music* (Tia Chucha, 1999), winner of the Kate Tufts Discovery Award.

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Briefly Noted

Pitt's Shona Sharif African Dance and Drum Ensemble Presents *Nativity: A Christmas Gift*

The Shona Sharif African Dance and Drum Ensemble, part of the University of Pittsburgh Department of Africana Studies, will present its musical production of *Nativity: A Christmas Gift* on weekends from Dec. 4 through Dec. 19 in the Seventh-Floor Auditorium of Alumni Hall.

Inspired by Langston Hughes' *Black Nativity,* the show explores the Christmas season through traditional West African dance and 20th-century gospel music.

Nativity: A Christmas Gift will be performed at 8 p.m. Fridays and Saturdays and 5 p.m. Sundays. There will be one school matinee at 10 a.m. Dec. 10. Tickets are $20 general admission and $10 for senior citizens, students, and children. They can be purchased at the door or reserved by calling 412-648-2276.

—By Sharon S. Blake

Nationality Rooms Holiday Open House to Be Held Dec. 5

The University of Pittsburgh's 27 Nationality Rooms committees will host their annual open house from noon to 4 p.m. Dec. 5. The rooms, located on the Cathedral of Learning's first and third floors, will be decorated in holiday splendor, displaying holiday customs from around the world. The rooms remain decorated until Jan. 14, and both taped and guided tours are available. On Saturdays—Dec. 4, 11, and 18—taped tours will be available from 9 a.m. to 2:30 p.m. On Sundays—Dec. 12 and 19—taped tours will be available from 11 a.m. to 2:30 p.m.

Guided tours will be offered Dec. 27-31 beginning at 10:30 a.m., and the last tour will be dispatched at 2:30 p.m. Tours commence every half hour. Taped tours are unavailable during these times.

Tickets can be purchased at the Gift Shop on the first floor of the Cathedral of Learning; reservations are not accepted. Admission is $3 for those 19 and older, and $1 for youths ages 8-18. Children under 8 are free.

For more information, visit www.pitt.edu/~natrooms or call 412-624-6000.

—By Jessica Myers

New Society for Planned-Giving Donors Launched

The Nov. 3 launch of the Brackenridge Circle at the Carnegie Museum of Art

Continued from page 1

R. Baierl (EDUC '51)
- Rita M. Bean (EDUC '67, '74), Pitt Professor Emeritus of Education, and R. Tony Eichelberger, Pitt Professor Emeritus of Education
- E. Maxine Bruhns, Director of Pitt's Nationality Rooms, and the late Fred C. Bruhns (GSPIA '69), Professor Emeritus of Comparative Public Administration in Pitt's Graduate School of Public and International Affairs
- James J. Duratz and the late Helene Barco Duratz
- Hilda Pang Fu (SIS '76) and Freddie H. K. Fu (MED '77), Distinguished Service Professor and David Silver Professor and Chair in the Department of Orthopaedic Surgery in the Pitt School of Medicine
- Carol Tsu Ho (SIS '68) and Monto Ho, Emeritus Professor and Chair in the Department of Infectious Diseases and Microbiology in the Pitt Graduate School of Public Health
- Lucine O'Brien Marous (CAS '84) and John Charles Marous Jr. (ENGR '49, '53), Pitt Trustee
- Marlin H. Mickle (ENGR '61, '64, '67), Nicholas A. DeCecco Professor and Executive Director of the RFID Center of Excellence in Pitt's Swanson School of Engineering
- Virginia S. Nicklas (KGSB '51)
- Jeanette Studley and Wesley C. Pickard (ENGR '61)
- Fred F. Weingruber (ENGR '49)
- Debi and Harold W. Wheeler
- Anonymous donor

Pitt Alumnus Terrance Hayes Wins National Book Award for Poetry

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Among Hayes' many honors are the Pushcart Prize, a Whiting Writers Award, three Best American Poetry selections, and fellowships from the National Endowment for the Arts and the Guggenheim Foundation. His work has appeared in *American Poetry Review*, *Poetry*, and *The New Yorker* and has been featured on the PBS *NewsHour*.

At Carnegie Mellon, Hayes developed Out Poetry, a readings-in-poetry course that explores the intersections of poetry and the public sphere. He has conducted workshops in prisons and high schools and at colleges and universities throughout the country.

Newman Receives Einstein Prize

Continued from page 1

Newman joins a select roster of physicists who have received the biennial $10,000 prize since its 2003 inception, including noted Einstein collaborators John A. Wheeler of Princeton University and Syracuse University (SU) physicist Peter Bergmann, Newman's mentor when he pursued his PhD degree at SU, which he earned in 1956.

In 1962, six years after Newman joined Pitt's Department of Physics and Astronomy, he and University of Oxford professor Roger Penrose developed the Newman-Penrose formalism, one of the most-cited sets of equations in relativity. In short, the formalism is an alternative method for describing Einstein's equations that replaces Einstein's own version, Newman explained.

The significance of the Newman-Penrose formalism is that it allows for special conditions to be imposed before one even attempts to solve an equation—conditions for which Einstein's original theory does not allow. Instead of using the four standard space-time coordinates, the Newman-Penrose equations use four different vectors to describe the geometric constructions of the theory that arise from massive objects in motion.

"We knew we had something good," Newman recalled. "We performed the Goldberg-Sachs theorem, which originally required a great deal of effort, at the drop of a hat. We knew it was a powerful technique then. I've used it virtually every day since the original paper, and when I lecture now to a technical audience, I assume that most people are familiar with it."

Three years later, in 1965, Newman inadvertently took part in constructing another important solution, the Kerr-Newman black hole.

As a hotshot young physicist, Newman stated in the *Journal of Mathematical Physics* that a class of solutions to Einstein's equations did not exist. In all of Newman's mathematics, however, there was one lowly plus-sign that should have been a minus. Roy Kerr, then a professor of physics at the University of Texas at Austin, discovered the error and found that the class of solutions did in fact exist. But it turned out that the now-correct equation easily allowed Newman to solve the Einstein-Maxwell equations for describing rotating, electrically charged black holes and their surrounding region. The Kerr-Newman stands as one of four solutions to Einstein's equations describing black holes.

In his more recent work, Newman investigates null foliation, or the patterns light rays form as they fill space-time. In 1980, Newman first identified a property known as H-space that occurs at the outer reaches of light's range when light rays no longer have physical contact—like the fingertips of a splayed hand. Newman is currently working on possible applications of H-space theory for explaining observable phenomena. [Also known as Heaven theory after a good-natured play on the "H" coined fittingly at a lecture Newman gave in Israel. The work gained notoriety after antipork-spending crusader Sen. William Proxmire (D-Wisconsin) took the name seriously and decried Newman's National Science Foundation grant application for a project to find "Heaven." Newman got the grant anyway.]

Newman's outpouring of research and many collaborations characterize the spirit of the golden age of general relativity that fell approximately between 1955 and 1975, he said.

Contemporary audiences may struggle to imagine a time when Einstein's theories were not highly regarded. Yet, when Newman entered Syracuse in 1951 as a graduate student in Bergmann's lab, general relativity was out of fashion, having been superseded since the mid-1920s by quantum theory. There were rumblings, however, partly attributable to Einstein's dismissal of major quantum principles, that quantum theory had serious shortcomings. Bergmann—who collaborated with Einstein on his unified field theory work—and his group began to revisit general relativity along with research groups at Princeton, in the United Kingdom, and in Eastern Europe.

"When I joined Bergmann's group, general relativity was in the doldrums. No one worked on it, and Einstein, though honored as a great thinker, was considered to be passé, a fogey," Newman said.

"But groups in a handful of institutions around the world began accepting Einstein's theory of relativity as relevant to the physics of the day. There was an open exchange of ideas among the different groups that stimulated a rapid revitalization of relativity," Newman continued. "Soon, a deeper understanding of the Einstein equations was developed and predictions of the existence and properties of gravitational waves were made. The theory of relativity became mainstream.

"Those were wonderful years of friendship and collaboration."

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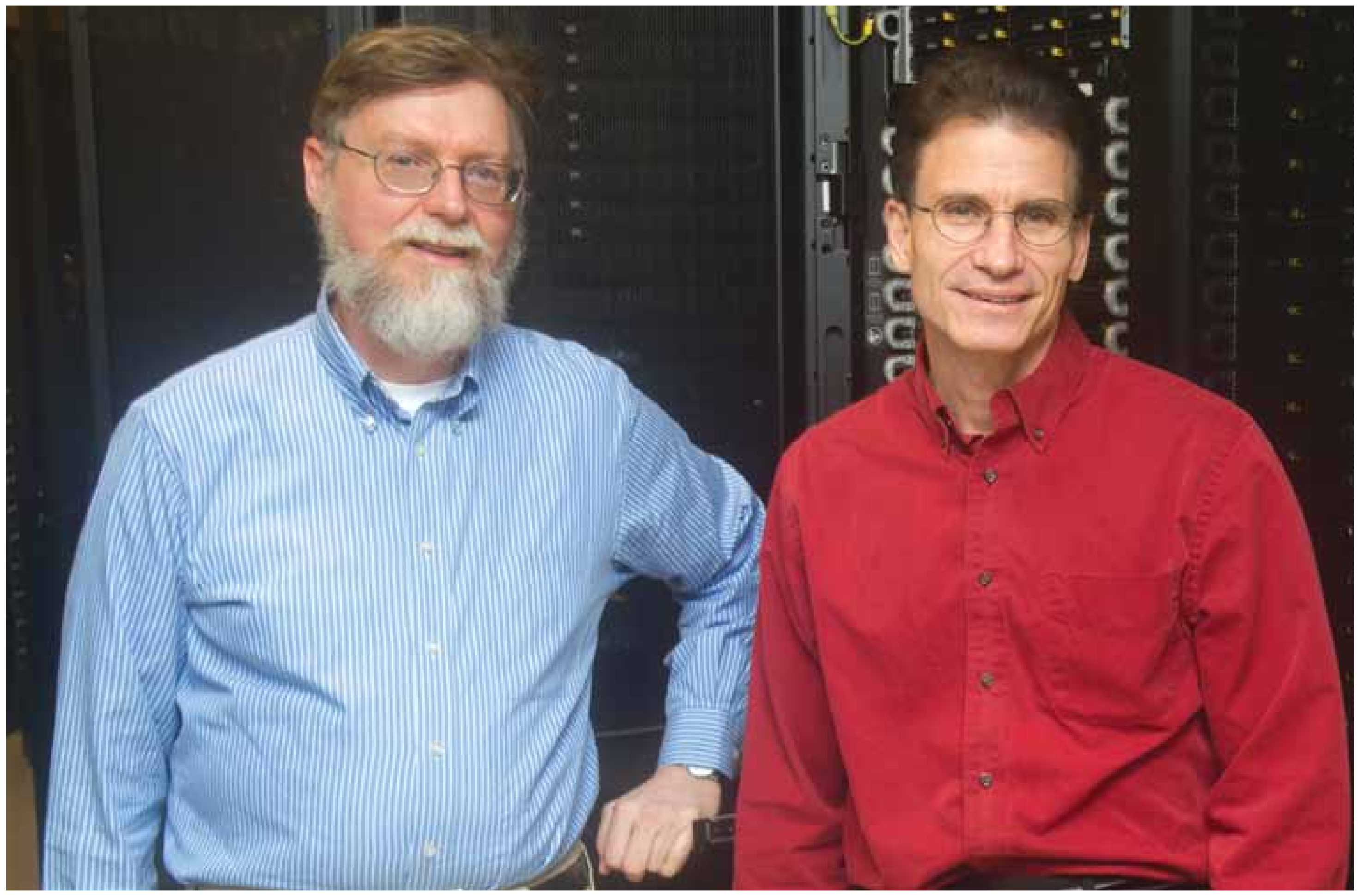
Spotlight on **Research**

Transformational Research Through Modeling and Simulation

By Jeffrey Fraser



MIKE DRAZDZINSKI/CIDDE

Pitt's Center for Simulation and Modeling (SAM) is codirected by Kenneth D. Jordan (left), Distinguished Professor of Computational Chemistry, and J. Karl Johnson, W.K. Whiteford Professor and Interim Chair in the Department of Chemical and Petroleum Engineering. The center, a multidisciplinary research organization established in Fall 2008, helps Pitt researchers tackle large-scale questions through the use of enormously fast and complex computers. Jordan and Johnson are standing in Eberly Hall, where a number of the center's computer banks are located.

Pitt researchers tackle some of the most complex issues of our times in the University's new Center for Simulation and Modeling.

Infectious disease. Global warming. The world economy. These are vastly different subjects, yet all have some things in common. All are complex systems influenced by multiple external stimuli. All have intense importance for humanity, deciding who lives, where they live, and how they live. And our understanding of all three can be advanced through computer simulation.

Researchers at the University of Pittsburgh are building powerful models to simulate complex phenomena. Armed with these new models and aided by the help of more and increasingly powerful microprocessors, they are asking essential questions that would have been unthinkable to ask computationally as recently as 10 years ago. Pandemics, climate change, banking meltdowns—all can be described by algorithms, and all can be simulated with powerful computers.

Growing cohorts of researchers from a broad array of disciplines have used computer modeling to tackle some of the biggest challenges in their fields. Yet, despite the phenomenal increase in the power of computers, traditional simulation tools have been limited because they do not adequately address multiscale processes occurring across large space and time scales.

A Giant Step Forward in Simulation and Modeling

This limitation is being addressed on a large scale at the University of Pittsburgh through the Center for Simulation and Modeling (SAM), a multidisciplinary research center established in Fall 2008, that works with Pitt researchers to develop new multiscale approaches for simulation and modeling. The center also helps foster collaborations across disciplines in modeling and simulation.

Researchers at the University of Pittsburgh are building powerful models to simulate complex phenomena. Armed with these new models and aided by the help of more and increasingly powerful microprocessors, they are asking essential questions that would have been unthinkable to ask computationally as recently as 10 years ago. Pandemics, climate change, banking meltdowns—all can be described by algorithms, and all can be simulated with powerful computers.

"Multiscale modeling has the potential to revolutionize the way science is conducted; to foster transformational research; and to stimulate the advancement of new technologies that can have an unprecedented impact on materials, energy, medicine, and many other fields," says George Klinzing, Pitt's vice provost for research.

SAM is codirected by Kenneth D. Jordan, Distinguished Professor of Computational Chemistry, and J. Karl Johnson, W.K. Whiteford Professor and Interim Chair in the Department of Chemical and Petroleum Engineering. The center has available a computer cluster with 2,000 cores connected by a high-speed Infiniband network, which greatly speeds up demanding calculations that require simultaneous use of multiple CPUs (Central Processing Units). A unique feature of the center is its team of PhD-level consultants with expertise in various facets of computer modeling and simulation. The consultants work closely with research groups, assisting in improving the performance of their computer codes and in making the transition to parallel computing platforms.

SAM engages in a wide range of other activities on campus, e.g., developing and teaching new graduate-level courses on scientific computing, organizing workshops on emergent computing technologies and on software applications of interest to researchers in multiple disciplines, and running a multidisciplinary seminar series on high-performance computing. An exciting new development is a partnership with the University's Computing Services and Systems Development (CSSD) group in making available a new computer cluster with the latest-generation Intel and AMD CPUs as well as NVIDIA GPUs (Graphical Processing Units, which are specialized coprocessors that enable extremely fast floating point computations).

The center serves as a focal point where almost 50 faculty members (plus more than 100 graduate students) from diverse fields share their experiences and expertise with one another. The thematic focus areas of SAM are energy and sustainability, nanoscience and materials engineering, medicine and biology, public health, and economics and other social sciences.

Leaving the Serial World

Computers traditionally have operated serially, processing one line of code, then another, and another. But microchip speed is topping out, and chip designers are now putting more CPUs, or cores, on a single chip—meaning that even desktop computers have parallel computing capabilities. The benefits to this kind of programming are obvious: A simulation that takes a year to complete on one processor would take less than a day if one could get it to run efficiently on 512 processors.

"Leaving the serial world behind is no small task," says Johnson, who adds that he grew up in a serial world. "The problem with the shift toward parallel programming is that very few people know how to do it, and there's a huge demand for people who really understand it."

When the University asked its faculty what they needed in a computational center, Klinzing says, their answer was, "We need high-level consultants; we don't just need hardware." In response to that need, SAM was created to provide in-house, PhD-level computational consultants who advise faculty and their students.

The center allows researchers from across the University to be able to tap more easily into experts like Liz Marai, assistant professor of computer science. Marai's specialty is data modeling and visualization, the conversion of mountains of numbers into visual representations that can then be used for interpretation.

For example, Marai has recently teamed up with SAM as part of an interdisciplinary research group led by Caterina Rosano in the Department of Epidemiology in Pitt's Graduate School of Public Health (GSPH). The project aims to provide practical computational tools for analyzing the correlation of mobility characteristics in older adults with brain pathophysiological processes. Marai and her students are developing advanced visualization strategies and tools for analysis of MRI data and their correlation to mobility measurements.

"We take numbers and measurements and try to generate insight," says Marai. "We run a tight loop between data, visualization, and analysis." Marai believes that the center has enabled computational research at Pitt to take a big step forward. "It fosters collaboration between experts from different fields. It's not just adding computing power, it's combining methodologies across disciplines to look at these really important questions—how galaxies are formed, how the human body works. Expert collaboration across disciplines can solve really big problems."

Toward Energy and Sustainability

Other important questions include those being asked about energy, sustainability, and the environment.

Jordan uses models to analyze the structure of methane hydrate, a compound formed from water and methane under high pressures at low temperatures. It is most abundant in deep ocean water and under the permafrost near the Arctic. The methane embedded in these deposits contains more potential energy than all known oil and natural gas reserves on the planet. It also represents a major potential contributor to global climate change. Methane is a potent greenhouse gas, 20 times more potent than

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Transformational Research Through Modeling and Simulation

MIKE DRAZDZINSKI/CODE

Computational chemistry professor Kenneth Jordan uses models to analyze the structure of methane hydrate, a compound that is most abundant in deep ocean water and under the permafrost near the Arctic. The methane embedded in those deposits contains more potential energy than all known oil and natural gas reserves on the planet. But methane is also a major potential contributor to global climate change. Jordan works with the U.S. Department of Energy's National Energy Technology Laboratory to simulate the structure and dynamics of methane hydrate. Like many Pitt researchers, Jordan collaborates with experimentalists at numerous institutions, including Yale and Purdue universities.

Continued from page 3

carbon dioxide (CO_2), and, as the polar region warms, the melting permafrost may release the vast supply of methane beneath it.

Either way, understanding methane hydrate's mysterious properties is crucial. Jordan is working with the U.S. Department of Energy's National Energy Technology Laboratory to simulate the structure and dynamics of methane hydrate. In hydrates, water molecules form polyhedral cages around methane molecules. Simulations allow Jordan's team to explore questions about methane hydrate that would be nearly impossible otherwise. "On the computer, we can study the network of cages without the methane molecules—something that cannot be done experimentally," he says.

Jordan's group also is studying a hydrate that is formed from water and CO_2 molecules, which may be useful in sequestering CO_2, the world's most abundant greenhouse gas.

Like many researchers at the University, Jordan collaborates with experimentalists at numerous institutions, including Yale and Purdue universities, to combine his research with state-of-the-art experimental approaches.

Carbon dioxide also is an area of inquiry for Johnson, who is using computational modeling to understand how CO_2 interacts with many other materials. Johnson and his collaborators are hoping that the materials they help to design will one day be used to capture CO_2 and slow global climate change.

"For the next 20 to 50 years, we're going to be relying heavily on fossil fuels for energy," Johnson says. "How can we use that resource without releasing CO_2 into the atmosphere?" Johnson's group is modeling a class of nanoporous material compounds with "pores" 1/1000th the width of a human hair in diameter to understand how they interact with CO_2. He hopes their modeling will lead to the design of a material that can capture CO_2 from power-plant emissions. The captured CO_2 could then be stored through carbon sequestration.

> **The thematic focus areas of the Center for Simulation and Modeling are energy and sustainability, nanoscience and materials engineering, medicine and biology, public health, and economics and other social sciences.**

Modeling is helping one Pitt researcher to tackle another aspect of the energy challenge: how to make solar power more accessible. Geoffrey Hutchison, assistant professor of chemistry, uses computation to study a class of conductive plastics called polythiophenes. These materials can be used as photovoltaics and could become a cheaper alternative to silicon-based solar cells. Just as intriguing to Hutchison is that polythiophenes can be processed like inks. "You could paint this on the roof of every car and every building and have solar cells in all these places," Hutchison says.

Hutchison is experimenting with these plastics on the computer, simulating conductive properties of different molecules. "We can look at what happens if we change, say, a carbon atom into a nitrogen—you can do that on a computer, and to do that experimentally would take months."

Hutchison and his collaborators put together a group of 100 potential molecules and, through simulations, gleaned five or six that could be good candidates for solar cells. "A lot of these molecules look like things we could make, but we want to understand whether to put in the effort to make them," he says.

Laura Schaefer, a professor of mechanical engineering and materials science, Bicentennial Board of Visitors Faculty Fellow, and deputy director of the Mascaro Center for Sustainable Innovation at Pitt, uses computer modeling to develop green alternatives to chlorofluorocarbons (CFCs) and related polymers.

CFCs have long been used as refrigerants in air conditioning because their chemical profile allows them to draw away heat from the air around them efficiently and safely. But CFCs deplete the Earth's ozone layer, which blocks harmful solar radiation, and these chemicals will be phased out completely this year.

Hydrochlorofluorocarbons (HCFCs), the chemicals used to replace CFCs, are more environmentally friendly but still have a negative impact on the ozone layer. Regulators also will begin phasing out the most common HCFCs this year.

Schaefer, who also has used computer modeling to study the use of acoustics for refrigeration, is simulating how different combinations of chemicals would react to find a safe, efficient alternative. Her work involves multiscale modeling that predicts how the system as a whole will perform.

The urgency to develop a safer, more energy-efficient refrigerant is great; air conditioning accounts for one-sixth of U.S. household electricity use. Schaefer's work is leading to new understandings in the basic science of fluid dynamics, she says. "The theoretical insights have been really fascinating. We're learning a lot on how complex fluids behave at a small level. This could have far-reaching impacts for researchers in other fields."

> **"Pitt can be an international leader in this exciting new field. We're definitely on the front edge. My intuition is that soon, virtually every aspect of public health research and policy development will be supported by modeling and simulation, and Pitt is extremely well positioned to lead the field."**
> ***—Donald Burke***

Tracking Global Health

Computer modeling tools have become increasingly important to understanding and addressing global health problems. By using informatics and computational modeling and simulation, researchers and policymakers can understand more about current public health challenges and determine the best strategies to prevent disease and improve human health.

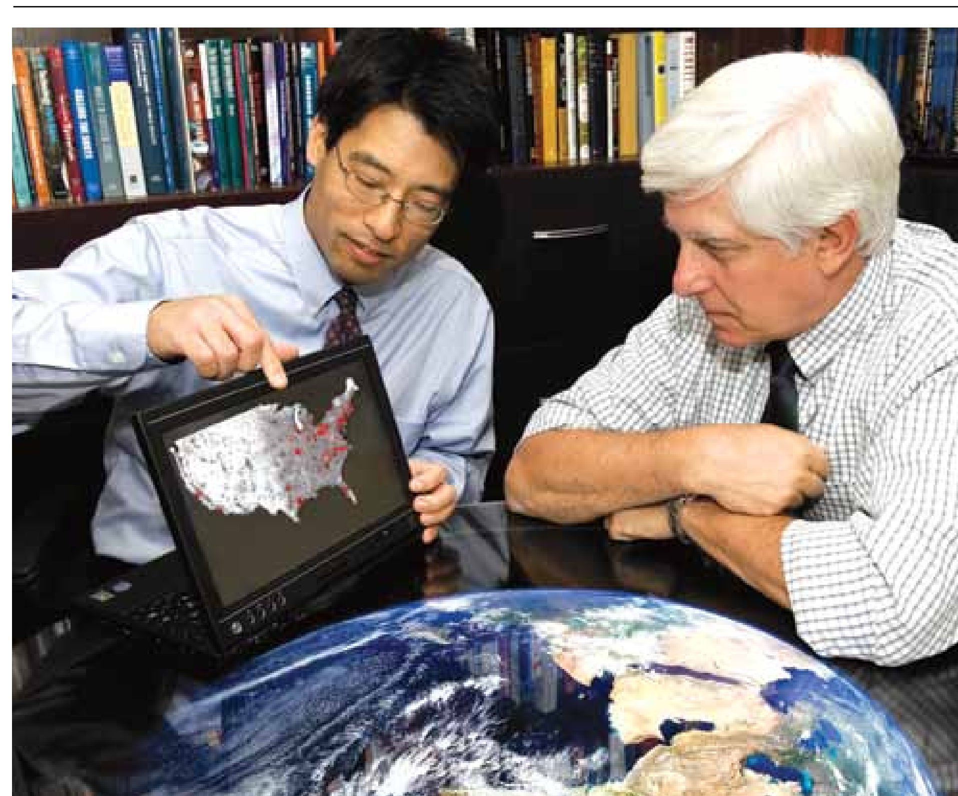
Modeling also can show how disease spreads through whole populations, as demonstrated by the work of Donald Burke, GSPH dean, UPMC-Jonas Salk Chair of Global Health, and associate vice chancellor for global health at Pitt. Burke is a pioneer in using computer modeling to understand the behavior of pandemic disease.

For decades, Burke tracked infectious diseases like HIV/AIDS and dengue fever throughout the developing world. In the 1990s, he began to think of pandemics as computable processes. "I now think of virus transmission as an algorithmic process, with underlying subprocesses and patterns," Burke says. "I never would have thought that way before I started to use computer modeling and simulation."

The computer model Burke and his collaborators designed to simulate an outbreak of avian flu in Southeast Asia—using transmission statistics from past epidemics, census data, and other social patterns—has helped the U.S. Department of Health and Human Services, U.S. Department of Homeland Security, and Centers for Disease Control and Prevention develop policies on travel restrictions, vaccinations, and school closures in the event of an outbreak. The Bill & Melinda Gates Foundation, which funds projects to help eradicate infectious disease, committed $10 million to Burke's group to build a model for the use of vaccines to contain epidemic diseases.

"Computer modeling allows us to test in silicon our ideas on populations," says Burke, and not just for epidemics of infectious diseases. Smoking, obesity, and drug use are all examples of public health problems where social behaviors spread from person to person in a fashion similar to contagious microbes and where modeling can help people think through and evaluate public policies designed to limit or reverse the spread of the behaviors, according to Burke. Pitt can be an international leader in this exciting new field, he says: "We're definitely on the front edge. My intuition is that soon, virtually every aspect of public health research and policy development will be supported by modeling and simulation, and Pitt is extremely well positioned to lead the field."

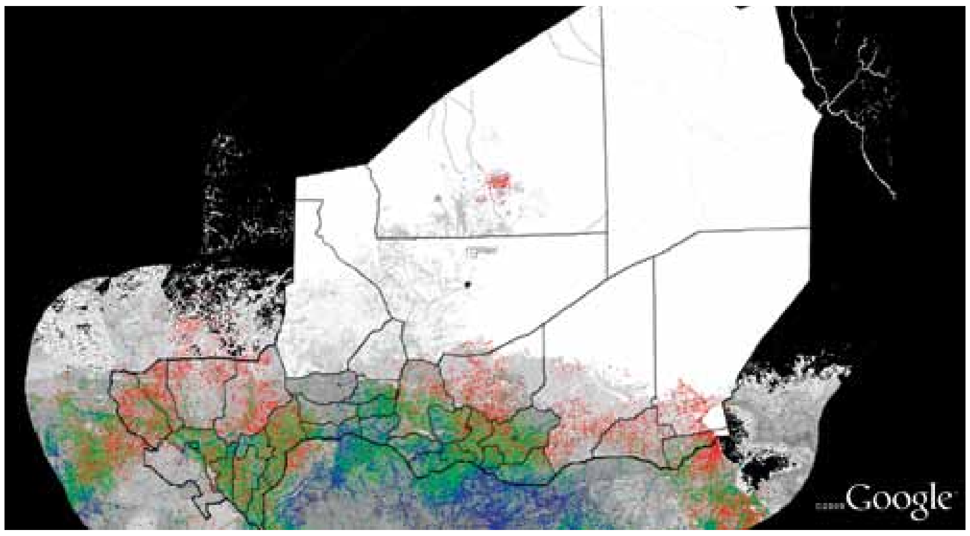
In 2009, the University was designated a MIDAS (Models of Infectious Disease Agent Study) National Center of Excellence,



JOE KAPELEWSKI/CODE

Computer modeling can show how disease spreads through whole populations. Donald Burke (right), dean of Pitt's Graduate School of Public Health and the UPMC-Jonas Salk Chair of Global Health, is a pioneer in using computer modeling to understand the behavior of pandemic disease. Burke and Bruce Lee, an assistant professor in GSPH and a core member of the recently founded Public Health Dynamics Laboratory, examine a map showing the spread of influenza throughout the U.S.

Spotlight on **Research**



As part of the Bill & Melinda Gates Foundation-funded Vaccine Modeling Initiative, researchers in Pitt's Graduate School of Public Health are developing computer models of disease spread and vaccine distribution. The above graphic shows the spread of measles throughout Niger, with colors changing from blue to green to red, representing increasing numbers of measles cases.

leading a collaborative network of scientists in the development and use of computational models that will prepare the nation to respond to outbreaks of infectious diseases. Recently, SAM consultants have teamed up with Bruce Lee, an assistant professor in GSPH and a core member of the recently founded Public Health Dynamics Laboratory. SAM is developing highly parallel computational modeling tools for studying patient and MRSA (a type of bacterial infection found commonly in hospitals) flow in human institutions such as hospitals and long-term care facilities.

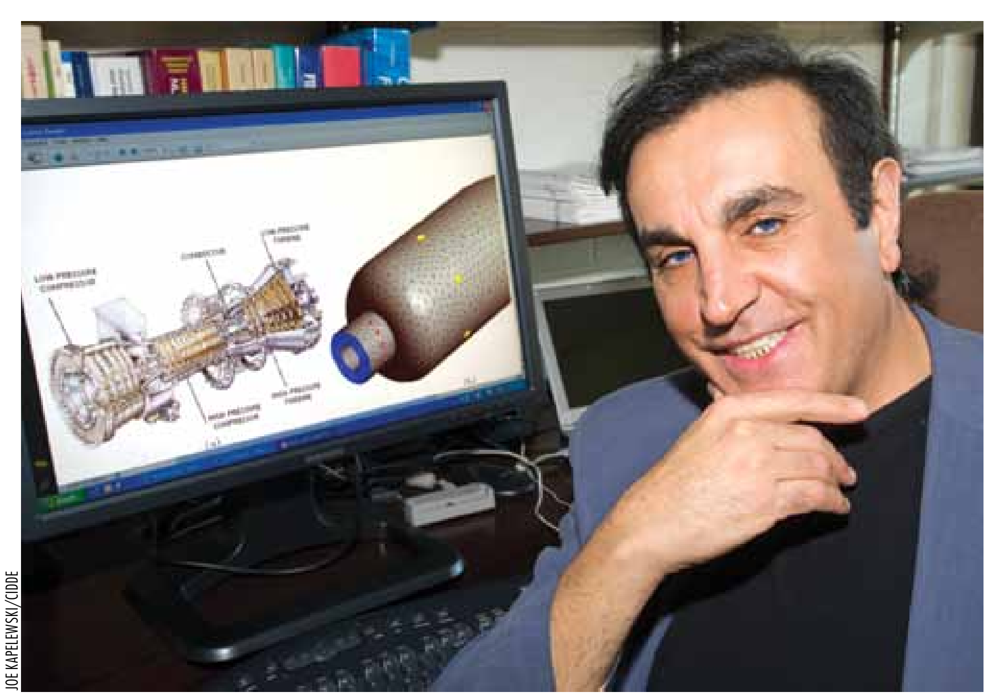
Embracing Turbulence

Anyone who's puzzled by an inaccurate weather forecast can appreciate why turbulence is one of the great problems of modern science. "Albert Einstein advised all his associates not to get involved with the problem of turbulence; it's a very chaotic phenomenon," says Peyman Givi, William Kepler Whiteford Professor in the Department of Mechanical Engineering and Materials Science and director of the Laboratory for Computational Transport Phenomena at Pitt.

Givi hasn't stayed away from turbulence—he's embraced it by developing unique methods of modeling the phenomena of turbulent combustion and high-speed combustion inside engines. He's gained attention for a novel way to combine two modeling methods—one employing exact calculations and another using probability—to provide an accurate way for engineers to experiment with engines even before they are built.

Rolls-Royce and NASA engineers already use Givi's model to predict temperature differential, fuel usage, and emissions for different engine and fuel combinations. Givi's models plot billions of fluid particles across hundreds of thousands of time intervals. It's a lot of work, but it saves countless amounts of time and energy for engineers trying to create more efficient, cleaner-burning engines.

"When you design an engine, you'd like to be able to know how it will work before you build it," Givi says. "Computer simulation allows people to do that." Givi is working in collaboration with SAM consultants to develop a powerful computational software with advanced parallelization techniques to enable simulations of ever-larger systems with unprecedented fidelity.



JOE KAPELEWSKI/CIDDE

Peyman Givi has received attention for his novel way of combining two modeling methods to provide an accurate way for engineers to experiment with engines even before they are built. Rolls-Royce and NASA engineers already use Givi's model to predict temperature differential, fuel usage, and emissions for different engine and fuel combinations. "When you design an engine, you'd like to be able to know how it will work before you build it," says Givi, the William Kepler Whiteford Professor in the Department of Mechanical Engineering and Materials Science and director of the Laboratory for Computational Transport Phenomena at Pitt. "Computer simulation allows people to do that."

Designer Materials and Nanotechnology

Just as Givi's models depict how engines will work before they are built, computer modeling allows researchers to test the properties of new materials and novel chemical compounds prior to their being built.

"If you can understand what's happening at the level of atoms, you can build things from the bottom up and create designer materials," says Johnson. His lab is using models to probe the physical properties of carbon nanotubes—long, strawlike molecules with very narrow diameters that scientists think may be useful for separating different gases or liquids. For example, a carbon nanotube membrane that selectively separates water from sodium chloride could be used as an easy, low-energy way to desalinate seawater.

Johnson and his group model how specific mixtures of molecules interact with these structures, showing, for instance, how quickly these materials flow through the nanotubes. Unless the flow rate is fast, the membrane will not be useful in practical terms for separating fluids. The model created by Johnson and his collaborators found that gases would pass much more quickly through the nanotubes than expected. Laboratory results published in a 2006 *Science* article by a separate research team supported some of the predictions Johnson's team made: The measured flow of gases and liquids was about 1,000 times faster through the nanotubes than through conventional porous membranes.

Jordan is using modeling to study one of the most abundant materials on Earth: water. "Although water is probably the most studied substance on Earth, we still don't understand all of its properties, many of which are unique," Jordan says.

Jordan's group simulates the behavior of small clusters of water containing up to 100 molecules. These studies are shedding new light on a wide range of processes, among them chemical reactions in the atmosphere and electrochemistry. One of the most important problems on which Jordan's group is working is whether charged particles, such as electrons and protons, prefer to be on the surface or in the interior of water clusters. This fundamental science question turns out to have far-reaching consequences, including those of environmental importance in atmospheric chemistry.

One researcher is using computers to model "sticky stuff"—wet or very fine granular material. Joseph McCarthy, a professor and William Kepler Whiteford Faculty Fellow in the Department of Chemical and Petroleum Engineering, studies the science of mixing sticky material. This is an important process in fields like pharmaceuticals, where a thimbleful of active chemicals must be mixed evenly into a roomful of flour-like substance. McCarthy and his collaborators build intricate models to see how best to mix these materials based on their size, density, and ability to be attracted to or repelled by water. They calculate the behavior and mechanics of billions of particles interacting over hundreds of thousands of time segments. This takes months to run across several high-powered processors. The time put into these models saves McCarthy and his colleagues from having to build time-consuming physical experiments.

The McCarthy group simulated a "chute flow" experiment, in which a substance is poured down a surface with a series of zigzags built into it. To construct a physical experiment, the team would have had to build a chute as high as 12-story Benedum Hall, which houses the Swanson School of Engineering. "We can make a lot of measurements you can't do when you're working experimentally," McCarthy says.

Computer modeling is allowing Anna Balazs, Distinguished Professor of Chemical Engineering and Robert Von der Luft Professor, to explore the creation of nanomachines that behave in much the same way human cells do.

Balazs uses simulations to study how microcapsules—synthetic bubbles roughly the size of a human blood cell—moving across a surface could form an artificial "skin" on a damaged material. She also has simulated communication between these synthetic bubbles using a route similar to that used in processes occurring in cell signaling. These materials one day could form the basis for chemical sensors that "heal" defective surfaces.

"This artificial skin is essentially a coating that could indicate where a surface has been damaged," Balazs says. She believes that her simulations will help experimentalists to follow the "recipe" for the nanomachines her team has created using computational modeling.

Unlocking the Body's Mysteries

Modeling is becoming an invaluable tool for many Pitt researchers in medicine and biology. From studying proteins at the atomic level to focusing on the body's immune system, models let these University researchers quickly test theories—enabling innovations that could help save many lives down the road.

Modeling is becoming an invaluable tool for many Pitt researchers in medicine and biology. From studying proteins at the atomic level to focusing on the body's immune system, models let these University researchers quickly test theories—enabling innovations that could help save many lives down the road.

Lillian Chong, Pitt assistant professor of chemistry, uses computer simulations to study proteins, the body's workhorses, in order to understand better the roles they play in the biological pathways of the cell. Chong studies natively unfolded proteins—so named for their seemingly disordered structure—which include a protein called tumor suppressor p53, thought to play a role in cancer. Proteins initiate important chemical functions in the body by "folding" into target molecules.

Chong's group simulates the kinetics of these protein interactions on tiny time intervals of femtoseconds (one quadrillionth of a second). "There's no way you could get that level of time detail without a computer," Chong says. These simulations run through Folding@home, a unique collaboration based at Stanford University in which scientists use distributed computing to take advantage of idle computers around the world. They can run protein-folding simulations on a network of more than 600,000 idle personal computers and Sony PlayStation 3s.

The Center for Simulation and Mod-

Continued on page 6

Transformational Research Through Modeling and Simulation

Spotlight on **Research**

JOE KAPELEWSKI/CIDDE

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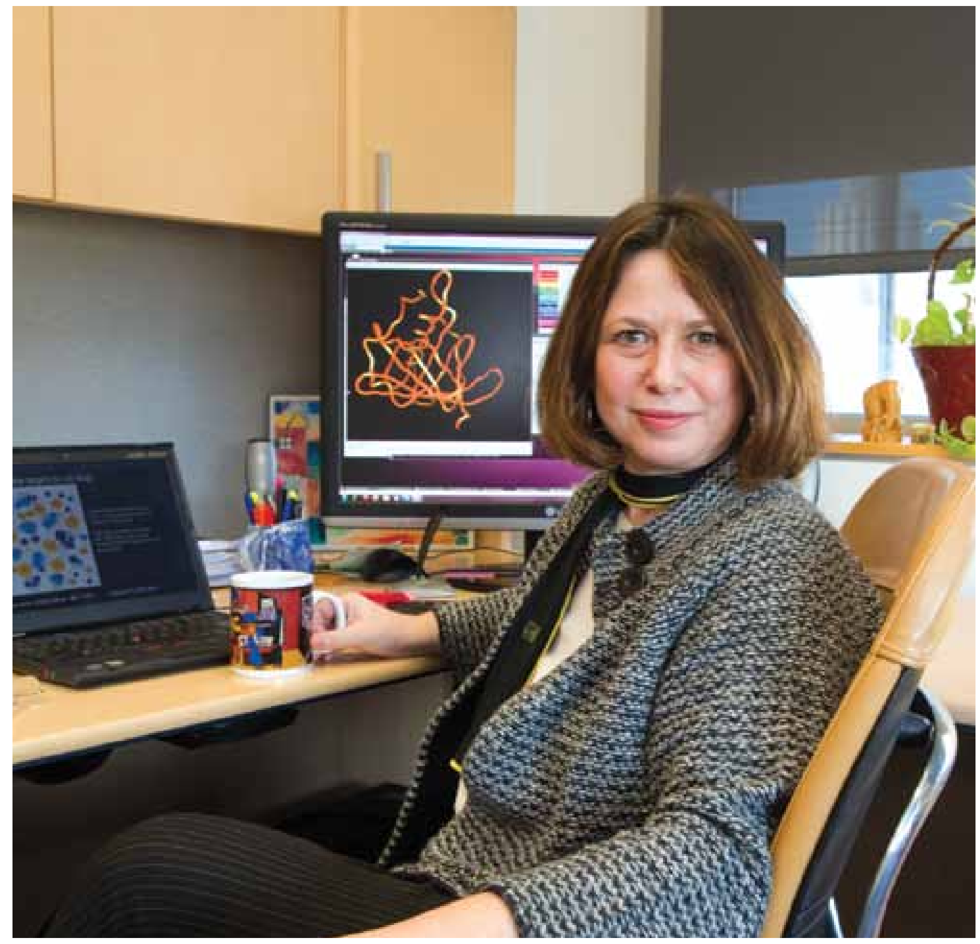

JOE KAPELEWSKI/CIDDE

Through computational models, Ivet Bahar and her colleagues in Pitt's School of Medicine simulate the interactions of proteins with potential inhibitors, small compounds that can limit the undesirable activities of some proteins. In collaboration with the Drug Discovery Institute, Bahar's lab members screen libraries of hundreds of thousands of chemical compounds for their potential to interact with target proteins in the search to identify promising drugs for further development. Such "virtual screening" can speed up the process of drug discovery, says Bahar, the John K. Vries Chair and professor of computational biology at Pitt.

Continued from page 5

eling is helping researchers to share their expertise and experience with others at Pitt. "It makes a lot of sense to have a center that supports that kind of faculty collaboration so we can leverage that kind of expertise from so many people in this community," she says.

Rob Coalson, Pitt professor of chemistry and physics, and his team model ion channels, one of the body's least understood but most important protein structures. These nanoscopic channels enable the passage of charged atoms like hydrogen, potassium, and chlorine through the body and are essential for everything from the creation and propagation of nerve signals and muscle contraction to the production of such chemicals as insulin.

> The Center for Simulation and Modeling is helping researchers to share their expertise and experience with others at Pitt. "It makes a lot of sense to have a center that supports that kind of faculty collaboration so we can leverage that kind of expertise from so many people in this community."
> *—Lillian Chong*

"Malfunction of ion channels is implicated as the root cause of many serious diseases and neuropsychiatric disorders, including cystic fibrosis, certain types of epilepsy, and migraine headaches," Coalson says.

According to Coalson, it is difficult to test ion channels in their natural environment within a living organism, but it's important that they be better understood, as about half of the drugs on the market today target ion channels and their protein cousins. Coalson's group has developed simulations that calculate the rate of ion flow through channels in cell membranes for various transmembrane voltages and electrolyte concentrations in order to gain insight into the relationship between channel structure and function.

Through computational models, Ivet Bahar, John K. Vries Chair and professor of computational biology, and her colleagues in Pitt's School of Medicine simulate the interactions of proteins with potential inhibitors, small compounds that can limit the undesirable activities of some proteins. In collaboration with the Drug Discovery Institute, Bahar's lab members screen libraries of hundreds of thousands of chemical compounds for their potential to interact with target proteins in the search to identify promising drugs for further development.

By doing "virtual screening," Bahar says, she and her collaborators can not only increase the likelihood of identifying more potent inhibitors but also speed up the process of drug discovery. Other members of the computational biology department also use computational tools to study the role of microRNA, tiny strands of genetic material, in regulating the immune response with respect to cancer and in understanding the complex biophysics of cell signaling.

G. Bard Ermentrout, University Professor of Computational Biology and Pitt professor of mathematics, uses computational modeling to simulate complex medical phenomena. Ermentrout, who's used modeling to study everything from the trailmaking properties of ants to the pigmentation design of mollusk shells, frequently collaborates with colleagues in the fields of medicine, neuroscience, and biology to study how certain patterns occur.

Ermentrout and his collaborators use models to understand the immune response during sepsis, a potentially fatal condition in which the body's response to infection inflicts "collateral damage" on internal organs like the lungs. They are trying to model how the immune system response in sepsis reaches a tipping point after which the body's own immune defenses start causing more harm than good. "At what point does the immune feedback become overwhelming and start to avalanche and cause problems?" Ermentrout asks.

Ermentrout also has used modeling to study phosphenes, the geometric visual patterns that occur when one looks at strobe lights, hallucinates, or enters a pre-epileptic state. He thinks that the patterns represent neural activity transposed directly onto the brain during those instances when the brain's visual apparatus is knocked off its usual setting.

"There are some problems in science that really lend themselves to modeling," says Ermentrout. "We're trying to find the algorithms that generate these patterns."

Forecasting the Uncertain

Predicting how the world economy will react to a laundry list of economic contingencies—wars, resource shortages, or banking meltdowns, to name just a few—is no task for the faint of heart. "The devil is in the details," explains David N. DeJong, a professor and former chair of the Department of Economics who was recently named Vice Provost for Academic Planning and Resources Management. DeJong is trying to harness the power of computational methods to create economic forecasting models designed in part to chart reactions to such contingencies.

> Researchers at Pitt will continue to refine their understanding of the complicated systems they're modeling. They will collaborate heavily with experimentalists to test their theories against real-world data and explore new ways to make computational modeling even faster.

DeJong uses computer simulations to reconcile two branches of the field that don't always communicate with one another: theory and statistics. Statistics are invaluable in unearthing the details of economic trends, but, DeJong explains, "They don't really answer the question, 'How come?' "

DeJong has already begun this task, mapping theoretical models of economic behavior onto statistical models. He understands that because models are simplifications of reality, there are some things that models will have difficulty accounting for: "No matter how rich our understanding of the aggregate economy is, we're never going to get everything." For instance, how does a researcher account for the reaction of consumers to unforeseeable changes in their environment not built explicitly into the model, like the recent foreclosure crisis or instabilities in the banking sector?

But as our understanding of the relationship between tax policy, investment, and consumption increases, DeJong and other economists increasingly will use structural models to read the economic tea leaves.

"What I'd like to do is to be able to answer questions like 'Should the Federal Reserve Board be more worried about interest rates or inflation?' or 'What are the effects of a tax holiday going to be?' I'll fire up the model and give you an answer," DeJong says.

Traditional Methods, New Tools

Researchers at Pitt will continue to refine their understanding of the complicated systems they're modeling. They will collaborate heavily with experimentalists to test their theories against real-world data and explore new ways to make computational modeling even faster. In these ways, computational modeling is not so far removed from the most rudimentary rules of scientific inquiry that have been around for centuries: observe, experiment, and analyze.

As Givi says, "In almost anything we do in science, we use what we know and model what we don't. The issue is how do you combine these two worlds to come up with a unified methodology? That's where we are putting our efforts."

Happenings

Festival of World Music, with Carpathian, Gamelan, and African Music and Dance ensembles, December 4

Concerts

Pacifica Quartet, performing Beethoven, Shostakovich, and Schubert, 7:30 p.m. **Nov. 29,** Carnegie Music Hall, 4400 Forbes Ave., Oakland, Carnegie Music Hall Chamber Series, Pittsburgh Chamber Music Society, 412-624-4129, www.pittsburghchambermusic.org.

Highmark Presents Chris Botti, Grammy-nominated trumpeter, 7:30 p.m. **Nov. 30,** Heinz Hall, 600 Penn Ave., Downtown, Heinz Hall Special Presentation, Pittsburgh Symphony Orchestra, 412-392-4900, www.pittsburghsymphony.org.

Grisha Goryachev, classical and flamenco guitarist, noon **Dec. 1,** Nordy's Place, Lower Level, William Pitt Union, free, Pitt ARTS' Artful Wednesdays, 412-624-4498, www.pittarts.pitt.edu.

Heinz Chapel Choir Holiday Concert, 5:15 p.m. **Dec. 2** free concert for Pitt affiliates; tickets sold out for all other performances, Heinz Chapel, Pitt Department of Music, 412-624-4125, www.music.pitt.edu.

Eve Goodman and John Caldwell, folk music performers, noon **Dec. 3,** Cup & Chaucer Café, ground floor, Hillman Library, free, Pitt Library System and Calliope: The Pittsburgh Folk Music Society, www.calliopehouse.org/legends.htm.

Highmark Presents Chris Botti, Heinz Hall, November 30

Pitt Men's Glee Club Holiday Concert, 8 p.m. **Dec. 3,** First Baptist Church of Pittsburgh, 159 N. Bellefield Ave., Oakland, free to Pitt students with ID, tickets must be reserved in advance, Pitt Department of Music, 412-624-4125, www.music.pitt.edu.

Verdi Requiem, with conductor Manfred Honeck and The Mendelssohn Choir of Pittsburgh, **Dec. 3-5,** Heinz Hall, 600 Penn Ave., Downtown, Pittsburgh Symphony Orchestra, BNY Mellon Grand Classics, 412-392-4900, www.pittsburghsymphony.org.

Festival of World Music, featuring Pitt's University Gamelan Ensemble, African Music and Dance Ensemble, Carpathian Ensemble, and Japanese music ensemble, 2-6 p.m. **Dec. 4,** William Pitt Union Ballroom, free, Pitt Department of Music, 412-624-4125, www.music.pitt.edu.

Renaissance City Choirs Holiday Concert, Pittsburgh's gay and lesbian choirs performing traditional carols and featuring the Edgewood Symphony Orchestra, 8 p.m. **Dec. 11,** Carnegie Music Hall, Oakland, tickets available by calling 412-362-9484, or online @ www.rccpittsburgh.org.

Exhibitions

Frick Art and Historical Center, *For My Best Beloved Sister Mia: An Album of Photographs by Julia Margaret Cameron,* works by one of the Victorian Era's best-known master photographers, **through Jan. 2,** 7227 Reynolds St., Point Breeze, 412-371-0600, www.frickart.org.

Andy Warhol Museum, *Marilyn Monroe: Life as a Legend,* **through Jan. 2,** 117 Sandusky St., North Side, 412-237-8300, www.warhol.org.

Carnegie Museum of Art, *Ordinary Madness,* **through Jan. 9;** *André Kértesz: On Reading,* photography exhibition, **through Feb. 13,** 4400 Forbes Ave., Oakland, 412-622-3131, www.cmoa.org.

Senator John Heinz History Center, *Vatican Splendors: A Journey Through Faith and Art,* **through Jan. 9,** 1212 Smallman St., Strip District, 412-454-6000, www.heinzhistorycenter.org.

Mattress Factory, *Queloids: Race and Racism in Cuban Contemporary Art*, **through Feb. 27,** 500 Sampsonia Way, North Side, Pitt's Center for Latin American Studies, 412-322-2231, www.mattress.org.

August Wilson Center for African American Culture, *In My Father's House*, mixed-media exhibition about how African Americans collect and preserve their culture, **through June 2011,** 980 Liberty Ave., Downtown, Pittsburgh Cultural Trust, 412-456-6666, www.pgharts.org.

Lectures/Seminars/ Readings

"Waiting for Landauer," John D. Norton, director, Pitt Center for Philosophy of Science, 12:05 p.m. **Nov. 30,** 817R Cathedral of Learning, Lunchtime Talk Series, Pitt Center for Philosophy of Science, 412-624-1052, pittcntr@pitt.edu.

"What Becomes of Tristan and Yseult in the Renaissance?" Jane Taylor, professor, Durham University, UK, 4:30 p.m. **Nov. 30,** 252 Cathedral of Learning, Pitt Medieval and Renaissance Studies Program, Department of French and Italian Languages and Literatures, Department of the History of Art and Architecture, and Women's Studies Program, 412-624-3246, www.medren.pitt.edu.

Leslie Crutchfield, author and philanthropist, free lecture on philanthropic strategies and her upcoming book, *Do More Than Give* (Jossey-Bass), 3:30-5:30 p.m. **Dec. 1,** Ballroom B, University Club, Pitt Graduate School of Public and International Affairs' Philanthropy Forum, gspiapf@pitt.edu.

"The Sino-American Dispute Over the Renminbi Exchange Rate," Pei Liu, visiting scholar in Pitt Department of Economics, noon **Dec. 2,** 4130 Posvar Hall, Asia Over Lunch Lecture Series, Pitt's Asian Studies Center, 412-648-7370 or asia@pitt.edu.

"Do Human Beings Have a Nature?" Richard Samuels, visiting fellow, Pitt Center for Philosophy of Science, 12:05 p.m. **Dec. 3,** 817R Cathedral of Learning, Lunchtime Talk Series, Pitt Center for Philosophy of Science, 412-624-1052, pittcntr@pitt.edu.

"Teaching World History Since 1500," one-day workshop taught by Thomas Anderson, Pitt's World History Center postdoctoral fellow, 9 a.m. -3 p.m. **Dec. 4,** $50 fee, Pitt World History Center, 5604 Posvar Hall, www.worldhistory.pitt.edu.

"The Lake Has No Saint," Stacey Waite, teaching fellow, Pitt Women's Studies Program, book release reception and reading, 7:30 p.m. **Dec. 4,** WYEP-FM Community Broadcast Center, 67 Bedford Square, South Side, Pitt Women's Studies Program, wstudies@pitt.edu.

"Career and Family Conumdrum," Claudia Goldin, Henry Lee Professor of Economics, Harvard University, 3:30-5 p.m. **Dec. 6,** Ballroom B. University Club, Pitt Department of Economics' 2010 McKay Lecture, 412-682-0140.

Miscellaneous

Fresa y Chocolate, (1994, Tomás Gutiérrez Alea), 6:30 p.m. **Nov. 30,** Frick Fine Arts Auditorium, *Cuban Eyes/Cubanize: Fifty Years of Cuban Cinema Since the Cuban Revolution* film series, Pitt's Center for Latin American Studies, Department of Hispanic Languages and Literatures, www.amigocinelatinoamericano@gmail.com.

Roble de Olor, (2002, Rigoberto López), 6:30 p.m. **Dec. 2,** Frick Fine Arts Auditorium, *Cuban Eyes/Cubanize: Fifty Years of Cuban Cinema Since the Cuban Revolution* film series, Pitt's Center for Latin American Studies, Department of Hispanic Languages and Literatures, www.amigocinelatinoamericano@gmail.com.

Pitt Nationality Rooms' Holiday Open House, Cathedral of Learning Commons Room, 27 Nationality Rooms are decorated in holiday splendor, noon-4 p.m. **Dec. 5,** Pitt Nationality Rooms Committee, 412-624-6000.

Opera/Theater/ Dance

The Last Days of Judas Iscariot by Stephen Adly Guirgis, Pitt Repertory Theatre's student lab theatrical performance, **Dec. 1-5,** Studio Theatre, Cathedral of Learning, Pitt Repertory Theatre, Department of Theatre Arts, 412-624-0933, www.play.pitt.edu.

The Morini Strad by Willy Holtzman, inspired by true story that rocked the classical music world, **through Dec. 12,** City Theater, 1300 Bingham St., South Side, 412-431-2489, www.citytheatre-company.org.

Talley's Folly, Pulitzer Prize-winning romantic comedy by Lanford Wilson, **through Dec. 12,** O'Reilly Theater, 621 Penn Ave., Downtown, Pittsburgh Public Theater, 412-316-1600, www.ppt.org, PITT ARTS Cheap Seats, 412-624-4498, www.pittarts.pitt.edu.

Pitt PhD Dissertation Defenses

Marquis Hawkins, Graduate School of Public Health's Department of Epidemiology, 9:30 a.m. **Nov. 29,** "The Relationship Between Physical Activity and Kidney Function/CKD," A523 Crabtree Hall.

Debra N. Thompson, School of Nursing, 10 a.m. **Nov. 29,** "A Multi-Level Study of Nurse Leaders, Safety Climate, and Care Outcomes," 219 Victoria Building.

Leida Tolentino, School of Arts and Sciences' Department of Psychology, 11:30 a.m. **Nov. 29,** "Second Language Swedish Morphosyntactic Instruction and Cross-Language Similarity: An ERP Investigation," Glaser Auditorium, first floor, Learning Research and Development Center.

Pamela E. Toto, School of Health and Rehabilitation Sciences, 9 a.m. **Nov. 30,** "Impact of a Multi-Component Exercise and Physical Activity Program for Sedentary, Community-Dwelling, Older Adults," 4065 Forbes Tower.

Shellie Rose, School of Arts and Sciences' Department of Geology and Planetary Science, 10 a.m. **Dec. 1,** "Thermal Infrared Remote Sensing of Active Basaltic Volcanoes: A Thermal and Spectral Deconvolution Approach," 214 Space Research Coordination Center.

Tae-Hoon Kim, School of Information Sciences' Telecommunications and Networking Program, noon **Dec. 1,** "Cross-Layer Resilience on Critical Points in Manets," 502 Information Sciences Building.

HENRI CARTIER BRESSON

***Marilyn Monroe: Life as a Legend,* Andy Warhol Museum, through January 2**

Hyekyoung Shin, School of Health and Rehabilitation Sciences, 9 a.m. **Dec. 2,** "Musculoskeletal Symptoms and Laptop Computer Use Among College Students," 4065 Forbes Tower.

Paulina H. Liang, School of Medicine's Cellular and Molecular Pathology Graduate Program, 10 a.m. **Dec. 2,** "Modulation of Bone Marrow-Derived Endothelial Progenitor Cells By Vascular Endothelial Growth Inhibitor (VEGI)," Nimick Conference Room, Hillman Cancer Center.

Alfred E. Simpson Jr., School of Education's Department of Health and Physical Activity, noon **Dec. 2,** "Psychological and Anthropometric Characteristics of Amateur Motorcycle Road Racers and Their Influence on Racing Performance," Conference Room, Baierl Recreation Center.

Jiangxia Liu, School of Medicine's Cellular and Molecular Pathology Graduate Program, 10 a.m. **Dec. 3,** "The Application of Metabolic Network Analysis in Understanding and Targeting Metabolism for Drug Discovery," 1105A Scaife Hall.

Philip Ganchev, School of Arts and Sciences' Intelligent Systems Program, 2:30 p.m. **Dec. 3,** "Transfer Rule Learning for Biomarker Discovery and Verification," First-Floor Conference Room, Parkvale Building.

Mónica Alejandra Canedo Sánchez de Lozada, School of Arts and Sciences' Department of Hispanic Languages and Literatures, 3 p.m. **Dec. 3**, "*El acto amoroso de la escritura en la ficción de Clarice Lispector*," 1528 Cathedral of Learning.

Jared D. Moretti, School of Arts and Sciences' Department of Chemistry, 4 p.m. **Dec. 3,** "Fluorous Mixture Synthesis of Sch725674 and Its Fifteen Stereoisomers," 307 Eberly Hall.

Pitt Music Department Offers Several Holiday Concerts

Pitt's Department of Music will present several holiday concerts during the next two weeks. Additional information is available by calling 412-624-4125 or visiting www.music.pitt.edu/events.

Dec. 3
Men's Glee Club Holiday Concert, 8 p.m., First Baptist Church of Pittsburgh, 159 N. Bellefield Ave., Oakland

Dec. 4
Festival of World Music, 2-6 p.m., Ballroom, William Pitt Union (WPU)
Carpathian Ensemble Dance Party, 6 p.m., WPU

Dec. 8
Pittsburgh Symphony Orchestra, free concert of Mahler's Symphony No. 4, 8 p.m., Bellefield Hall Auditorium

Note: Heinz Chapel Choir Holiday Concert tickets are sold out.

University of Pittsburgh

PittChronicle

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400 Craig Hall
200 South Craig Street
Pittsburgh, PA 15260

What Factors Contribute to the Success or Failure of Software Firms?

Pitt, McGill University, and Georgia Institute of Technology researchers find that it takes more than a good idea to succeed

By Amanda Leff Ritchie

Throughout the 1990s and 2000s, news about 20-somethings becoming billionaires from the sale of their software companies flooded the media, giving the impression that a good idea was all it took to succeed in the software industry. Jennifer Shang, a professor of business management in Pitt's Joseph M. Katz Graduate School of Business, along with colleagues Shanling Li of McGill University and Sandra Slaughter of the Georgia Institute of Technology, investigated what caused software companies to succeed or fail. Their research study, titled "Why Do Software Firms Fail? Capabilities, Competitive Actions, and Firm Survival in the Software Industry From 1995 to 2007," has been published in the journal *Information Systems Research*.

Because of low entry and exit barriers and low marginal-production cost, new-product development takes place rapidly in the software industry, says Shang. However, the industry's bankruptcy rate of 15.9 percent is much higher than the rates in other industries. For example, the bankruptcy rate in the pharmaceutical industry is 4.7 percent.

Jennifer Shang

Shang and her colleagues examined software-company data collected between 1995 and 2007 from 870 firms. The collaborators looked at three aspects of internal business capabilities—marketing, operating, and research and development. They also examined two types of competitive actions: those that were innovation-related (product and marketing actions) and those that were resource-related (capacity and scale expansion, operations, service, mergers, and acquisition). They found that a higher operating capability has the greatest influence on a software firm's chance of survival. Firms with a greater emphasis on innovation-related competitive actions have a greater likelihood of survival, and this likelihood increases when the firms also have higher marketing and operating abilities.

The researchers divided the software industry into three subsections: sector one, which included desktop suites and other business-enabling software; sector two, which included video games and graphics software; and sector three, which included operating systems and security programs. Depending on their sectors, software businesses need a slightly different approach to investments, says Shang. Firms producing games, for example, must emphasize marketing, whereas companies making products with a long life cycle (such as operating systems) must focus on operating abilities and research and development. Traditional software companies, those producing desktop applications, should follow a strategy somewhere between these two approaches.

"Our research underscores the importance of operating capability in the software industry," says Shang. "Managers of knowledge-based firms often emphasize big ideas (innovation). Our study shows that operational efficiency is even more important for firm

Because of low entry and exit barriers and low marginal-production cost, new-product development takes place rapidly in the software industry, says Pitt's Jennifer Shang. However, the industry's bankruptcy rate of 15.9 percent is much higher than the rates in other industries.

survival. Also, competitive strategies and dynamic actions will have more impact if they are supported by strong capabilities. In short, to improve performance and competitiveness, software companies should focus on synergies between firm capabilities and strategic actions."

PUBLICATION NOTICE The next edition of *Pitt Chronicle* will be published Dec. 6. Items for publication in the newspaper's *Happenings* calendar (see page 7) should be received at least two weeks prior to the event date. *Happenings* items should include the following information: title of the event, name and title of speaker(s), date, time, location, sponsor(s), and a phone number and Web site for additional information. Items may be e-mailed to chron@pitt.edu, faxed to 412-624-4895, or sent by campus mail to 422 Craig Hall. For more information, call 412-624-1033 or e-mail robinet@pitt.edu.