GRADUATE STUDY *at*

RICE

GRADUATE STUDY IN CHEMISTRY

RICE UNIVERSITY

The Department of Chemistry at Rice University provides a uniquely stimulating environment for scientific research. In addition to the classical research areas of organic, inorganic, physical and theoretical chemistry, interdisciplinary research has long been a central focus at Rice. We have minimal barriers between departments, and work that spans science and engineering is particularly facile here. Most chemistry faculty members hold joint appointments with other departments, including bioengineering, biochemistry and cell biology, chemical engineering, electrical and computer engineering, physics and astronomy, computer science, and mechanical engineering and materials science. We have a close relationship with Baylor College of Medicine, and many of our labs address problems in bio-organic, bio-inorganic, bio-materials and bio-physical chemistry. The collaborative environment at Rice was critical to the development of nanotechnolgy, having facilitated the work of two of the first Nobel laureates in the area. Nanotechnology has blossomed into a major strength of the department, which houses one of only six National Science Foundation-funded centers for nanoscale science and engineering. Students are encouraged to visit the Department of Chemistry Web page for more detailed information about faculty research.

Immersed in this environment of scientific discovery, the graduate program is designed to develop students' ability to conduct independent, creative, scientific research and cultivate habits of inquiry that will ensure continued intellectual development throughout their careers.

DEGREE REQUIREMENTS

The degree requirements at Rice are designed to maximize the number and quality of doctoral students' publications. Formal course requirements are unusually flexible: six one-semester courses in any relevant area of science or engineering. Teaching requirements are minimal at 8–10 hours per week for three semesters. The format of the qualifying exam is that each fourth-semester student writes a manuscript that describes his/her results and charts a course for future research. The committee works with the student to identify strengths and weaknesses of the work to facilitate completion of the work. The process is as much a mechanism to promote publication as it is an exam. The doctoral program culminates with a published dissertation presenting research that is an original and significant contribution to the field of chemistry. The atmosphere at Rice promotes industriousness and achievement, and the program typically can be completed in four and a half to five years of full-time study.

Rice University
Department of Chemistry
P.O. Box 1892, MS-60
Houston, TX 77251-1892

Phone: (713) 348-4082
Fax: (713) 348-5155
chem@rice.edu
Graduate Recruiting e-mail:
gradchem@rice.edu.

FOR MORE INFORMATION, VISIT: WWW.CHEM.RICE.EDU

CHEMISTRY FACULTY AND RESEARCH

Faculty hold joint appointments with [1] Biosciences, [2] Bioengineering, [3] Chemical & Biomolecular Engineering, [4] Computer Science, [5] Earth Science, [6] Electrical & Computer Engineering, [7] Materials Science & Manoengineering, [8] Physics & Astronomy [9] Civil & Environmental Engineering.

Pedro J. Alvarez[9], PhD (University of Michigan, 1992). Bioremediation of contaminated aquifers, fate and transport of toxic chemicals, water footprint of biofuels, microbial-plant interactions, water treatment and reuse, and environmental implications and applications of nanotechnology.

Pulickel Ajayan[3, 7], PhD (Northwestern, 1989). Multifunctional nanostructures and hybrid platforms for energy storage, composites, sensors, electronics and biomedicine.

Zachary T. Ball, PhD (with Trost, Stanford, 2004). Current research includes reaction discovery, biomimetic catalysis, and organometallics for biology and medicine.

Enrique Barrera[7], PhD (U of Texas, 1987) Interface studies and processing of composites, coatings, and thin films. Formation of hybrid nanotube materials and the development of fully integrated nanotube composites.

Andrew R. Barron[7], PhD (with Wilkinson, Imperial College, U of London. 1986). Chemistry, nanoscale science and materials science of the Group 13 elements leading to the development of new materials and catalysts.

Cecilia Clementi[3], PhD (International School for Advanced Studies 1998). Theoretical and computational investigation of protein folding, protein interactions and functions.

Michael Diehl[2], PhD (UCLA, 2002). Biomotor cooperativity, biomaterials, supramolecular biophysics and molecular bioengineering.

Jason H. Hafner[8], PhD (with Smalley, Rice 1998). Application of nanometer-scale tools and materials to problems of biological and biomedical interest.

Naomi J. Halas[2,6,8], PhD (Bryn Mawr, 1987). Nanofabrication chemistry and nano-optics.

Jeffrey D. Hartgerink[2], PhD (with Ghadhiri, Scripps, 1999). Self-assembly of nanostructured materials with a focus on molecular structure of proteins and peptide based biomaterials for tissue regeneration, drug delivery and other biomedical applications.

John S. Hutchinson, PhD (UT Austin, 1980). Theory of the dynamics of reactive molecular species.

Anatoly B. Kolomeisky[3], PhD (with B. Widom, Cornell, 1998). Theoretical physical chemistry, biophysics and statistical mechanics. Modeling of biological transport systems and protein-DNA interactions, and investigation of nanocars and other artificial nanoscale devices.

Christy F. Landes[6], PhD (with El-Sayed, Georgia Tech, 2003). Experimental physical, biophysical, and nanomaterials physical chemistry; single molecule spectroscopy. Dynamic complexity and its role in biological and synthetic polymer functions.

Stephan Link[6], PhD (with El-Sayed, Georgia Tech, 2000). Physical chemistry of nanomaterials, nanophotonics and plasmonics, spectroscopy of individual and coupled nanoparticles with applications in opto-electronics. energy, and medicine.

Angel Martí[2], PhD (U Puerto Rico, 2004). Development of molecules to diagnose and treat disorders that involve protein aggregates, e.g., Alzheimer'; development of supramolecular materials based on nanoscale building blocks.

Carrie Masiello[5], PhD (University of California, Irvine 1999). Fundamental mechanisms of the carbon cycle, carbon sequestration, climate change, black carbon, terrestrial-river-ocean biosphere interactions.

Seiichi P. T. Matsuda[1], PhD (with Corey, Harvard, 1994). Bioorganic and organic chemistry, terpenoid biosynthesis, enzyme evolution, re-design of enzymes to have new activities, and genomic approaches to find biologically active molecules.

John T. McDevitt[2,7], PhD (with Collman, Stanford, 1987). Interface of basic, applied and translational research in medicine as applied to nano-bio-chip sensor systems, integrated lab-on-a-chip devices and other diagnostic systems for their use in clinical chemistry.

Emilia Morosan[7,8], PhD (Iowa State, 2005). Design and synthesis of novel magnetic and superconducting materials.

K.C. Nicolaou, PhD (University College London, 1972). Synthesis of natural and designed molecules of biological and medical importance.

Jose Onuchic[1,8], PhD (Harvard, 1976). Theoretical and computational methods for molecular biophysics and chemical reactions in condensed matter; protein folding funnels as a mechanism for the folding of proteins.

Matteo Pasquali[3, 7], PhD (Minnesota, 1999). Interaction of flow and liquid micro- and nanostructure in complex fluids, with application to the manufacturing of engineered materials.

George Phillips[1], PhD (Rice University, 1976). Three-dimensional structure and dynamics of proteins to their biological functions, computational biology.

Emilie Ringe[7], PhD (Northwestern U, 2012). Atomic resolution and three dimensional elemental mapping of alloy nanoparticles relevant for catalysis applications.

Peter Rossky, PhD (Harvard, 1978). The elucidation of the fundamental molecular-level origins of chemical behavior in condensed phases and clusters

Gustavo E. Scuseria[7, 8], PhD (U. Buenos Aires, 1983). Development of theoretical and computational quantum chemistry techniques (many in the Gaussian program). Application of quantum mechanics to predict the structure and properties of molecules.

Ned Thomas[7,3], PhD (Cornell University, 1974). Polymer physics and engineering, photonics and phononics and mechanical and optical properties of block copolymers, liquid crystalline polymers, and hybrid organic-inorganic nanocomposites.

Isabell Thomann[6,7], PhD (University of Colorado at Boulder). Energy, photocatalysis, ultrafast spectroscopy and nanophotonics.

James M. Tour[4,7], PhD (with Negishi, Purdue, 1986). Organic chemistry, materials science, polymer chemistry, nanoscience, and nanotechnology.

R. Bruce Weisman[7], PhD (U Chicago, 1977). Basic studies of carbon nanotube spectroscopy and photophysics and related analytical, mechanical engineering and biomedical applications.

Kenton H. Whitmire, PhD (with Shriver, Northwestern, 1982). Inorganic and organometallic chemistry, precursor design for advanced nanomaterials, structural and mechanistic chemistry, catalysis, bioactivity of heavy main group elements.

Lon J. Wilson, PhD (U Washington, 1971). Nanoparticle development in biology and medicine. Nanotechnologically-enhanced medical imaging and therapeutic agents.

Peter G. Wolynes[1,7,8], PhD (Harvard, 1976). Theoretical chemical physics, theory of glasses, protein dynamics and folding. Stochastic cell biology.

Michael S. Wong[3,7], PhD (MIT, 2000). Chemical engineering, chemistry, and materials science, functional nanoparticle-based materials.

Boris I. Yakobson[7], PhD (Russian Acad. of Sciences, 1982). Theory and modeling of materials derived from macroscopic and fundamental molecular interactions.

Junrong Zheng, PhD (with Fayer, Stanford, 2007). Development of multiple-dimensional vibrational spectroscopic techniques to probe interfacial chemical and biological questions.

Eugene R. Zubarev [7], PhD (Russian Acad. of Sciences, 1998) Organic chemistry and polymer chemistry, synthesis and characterization of self-assembling molecules.

AMANDA GOODMAN AND NADIA LARA ARE RECIPIENTS OF THE 2013 NATIONAL SCIENCE FOUNDATION (NSF) GRADUATE RESEARCH FELLOWSHIP IN THE DEPARTMENT OF CHEMISTRY. THIRTEEN RICE STUDENTS WON THE NSF GRADUATE RESEARCH FELLOWSHIP WHICH RECOGNIZES STUDENTS WITH OUTSTANDING LEADERSHIP AND POTENTIAL IN ADVANCING SCIENCE AND ENGINEERING RESEARCH AND INNOVATION.

In addition to the equipment and facilities that individual research groups own, Rice's Shared Equipment Authority (SEA) provides a greater breadth of state-of-the-art research equipment and facilities to all members of the Rice University community. SEA also provides support and open instrumentation usage to outside companies, nano/bio/enviro start-ups and other universities subject to availability.

SEA supports more than 65 instruments, including:
The SEA infrastructure and management make it easy for new graduate students to become expert in electron microscopy, photonics,

- X-ray diffraction
- Optical microscopy
- Electron microscopy
- Scanning probe microscopy
- Optical spectroscopy
- Nuclear magnetic resonance
- Mass spectrometry
- Thermal analysis
- Clean room class 100/1000
- Micro/nano fabrication

bioinformatics, nanotechnology and environmental systems. For more information, visit: www.sea.rice.edu.

DEPARTMENT FACTS

- Our faculty has 35 tenure-track members.
- Four members of the National Academy of Sciences are on the faculty.
- The Nobel Prize was awarded to two Rice chemists for the discovery of "buckyballs."
- Our faculty-to-graduate student ratio is 3:1.
- The department has more than $10 million per year in research expenditures.
- Our graduate students achieve at a fantastic level (the mean number of papers they publish is >6).

PROGRAM HIGHLIGHTS

- State-of-the-art facilities
- Interdisciplinary research
- Flexible teaching requirements
- Strong medical collaborations
- Leaders in nanotechnology
- Generous financial support
- Fellowship opportunities
- Close-knit graduate student community

INSTITUTES AND RESEARCH CENTERS

Active chemically-oriented research in three major university institutes and other research centers helps foster a wide range of interdisciplinary programs at Rice. Almost every member of the chemistry faculty is active in these institutes.

Since 1979, the **Rice Quantum Institute** has brought together teams of scientists and engineers dedicated to research and higher education in areas relating to quantum phenomena. Members of RQI study a diverse range of effects, on scales ranging from atomic dimensions to interstellar distances. The increasing sophistication of experimental and theoretical technology continues to drive research, which both uses and advances our understanding of the natural world.

The 70 Fellows of RQI belong to eight different departments spanning the schools of Natural Sciences and Engineering at Rice University, reflecting the diverse and interdisciplinary nature of their interests. The simultaneous pursuit of basic and applied research provides a valuable training ground for careers in science and technology in the new millennium. www.rqi.rice.edu

The **Institute for Biosciences and Bioengineering** promotes cross-disciplinary research and education encompassing the biological, chemical and engineering disciplines. With 110 faculty members from 13 departments, the Institute fosters ties with the Texas Medical Center, creates partnerships with industry, and promotes the translation of research to facilitate strong research and training programs. www.ibb.rice.edu

The **Richard E. Smalley Institute for Nano¬scale Science and Technology** encourages collaboration to explore, model, fabricate, and manipulate structures at the atomic level. With more than 151 members in 21 departments participating in nanotechnology-related research, the Smalley Institute is a leader in nanoscale science and engineering. The Institute's focus includes nano-vivo, single-walled nanotubes, nanotechnology in energy, social and ethical issues and nanoengineering.

The Smalley Institute creates an outstanding environment for research and education at Rice, enhances the research infrastructure, and creates novel opportunities through interdisciplinary cooperation. www.smalley.rice.edu.

Additional centers and research labs at Rice University include: the **Center for Biological and Environmental Nanotechnology**, a National Science Foundation-funded **Nanoscale Science and Engineering Center** created to develop new areas of research and establish a nanotechnology workforce and the **Laboratory for Nanophotonics**.

Chemistry faculty members are also involved in relationships with outside organizations, including the Texas Medical Center, the Department of Defense and NASA's Johnson Space Center.

GRADUATE STUDENT PERSPECTIVE

The Chemistry Department at Rice has all the rigor and facilities of a large research institution while maintaining the atmosphere of a small community. Comprising a significant portion of the overall student body, graduate students at Rice have an active presence on campus. Their vibrancy and close-knit nature, fostered by activities like intramural sports and seasonal picnics, leads to cooperation between labs across various disciplines. In addition, Rice's proximity to one of the world's largest medical centers provides grad students with collaborations with top-tier medical researchers. Beyond the hedges of Rice, Houston is a great place to live and work. With the affordable cost of living in Houston, the plethora of multicultural tastes, sights and sounds of the city are available to students during their time at Rice.

Left to Right: Paul Bodager (Matsuda Research Group), Meghan Jebb (Wilson Research Group), and Jason Streit (Weisman Research Group)

Left to Right: Jorge Fallas Valverde (Former Graduate Student) and Dr. Seiichi Matsuda, Chemistry Professor and Department Chair

Students have access to an abundance of research tools at Rice. The high resolution 800 MHz NMR instrument is one of the many exceptional resources available.

ABOUT RICE AND HOUSTON

Rice is a leading American research university—small, private and highly selective—distinguished by a collaborative, interdisciplinary culture and a global perspective. Only a few miles from downtown Houston, it occupies an architecturally distinctive, 285-acre campus shaded by nearly 4,000 trees. State-of-the-art facilities and laboratories, internationally renowned centers and institutes and one of the country's largest endowments support an ideal learning and living environment.

The university attracts a diverse group of highly talented students and faculty with outstanding graduate and professional programs in the humanities, social sciences, natural sciences, engineering, architecture, music and business. With just 2,275 graduate students and 3,485 undergraduates, it offers an unusual opportunity to forge close relationships with eminent faculty scholars and researchers and the option to tailor graduate programs to specific interests.

Houston offers all the expected educational, cultural and commercial advantages of a large urban center, and more. It is home of the Texas Medical Center — the largest concentration of medical schools, hospitals and research facilities in the world — as well as several other universities. Rice has cooperative programs with the University of Houston, Baylor College of Medicine, the University of Texas Health Science Center and Texas Southern University. Houston is one of the few U.S. cities with resident companies in all four major performing arts—drama, ballet, opera and symphony. It also boasts a museum district featuring exhibits of national and international prominence.

As urban as it is, Houston also is a surprisingly green city. Houstonians enjoy the outdoors in more than 300 municipal parks and 120 open spaces, and many frequent the beach at Galveston Island, only a 45-minute drive away. Other short trips include Austin, the state's capital, and historic San Antonio, both of which are a little more than three hours away.

For more information about Houston visit:
www.rice.edu/houston

HOW TO APPLY

Only online applications are accepted and should include: application, transcripts, GRE scores and three letters of recommendation (international students should also provide TOEFL scores). The application deadline for the fall 2013 semester is January 1, 2013. Late applications may be considered until February 1, 2013, but late applicants place themselves in a less competitive position. The application fee is $85.00. We waive the application fee for international student who have subject GRE of 900 or greater, and for all domestic students.

Apply online at: www.chem.rice.edu
Rice University
Department of Chemistry–MS 60
P.O. Box 1892
Houston, TX 77251-1892
E-mail: gradchem@rice.edu
Toll-free phone: 1-877-348-8639

VISITING RICE

We encourage you to visit Rice at any time for a first-hand look at the department and the beautiful, tree-lined campus near the heart of historic Houston. We host department-funded campus visits for admitted students who are in the U. S. These visits are very useful to get to know the faculty and current graduate students from whom you can learn more about student life and Houston.

Feel free to contact the department with any questions you may have.

APPLICATION CRITERIA

The admissions committee seeks people who will develop into outstanding scientists. The mean scores of entering domestic students are GPA 3.7, Quantitative GRE 750, and Verbal GRE 600. However, we take recommendation letters of former instructors and research mentors much more seriously than these numbers.

FINANCIAL ASSISTANCE

All chemistry graduate students receive financial support throughout the 12-month year. Entering students are typically awarded Rice University fellowships, which carry stipends of $24,720 per year for 2012-2013 and an additional grant to completely cover tuition. Applicants with exceptional qualifications also compete for prize fellowships, which carry larger stipends plus tuition expenses. After the first semester, students are supported by faculty research grants as research assistants. Stipend levels are reviewed annually by the department and are periodically adjusted to reflect changes in the cost of living in the Houston area.

Incoming students are encouraged to apply for National Science Foundation Predoctoral Fellowships. Forms may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; 202-334-2872; or online at: www.nsf.gov.

Rice University is one of only 14 institutions at which fellowships from the Fannie and John Hertz Foundation are available to graduate students. Information may be obtained from the Fannie and John Hertz Foundation, P.O. Box 5032, Livermore, CA 94551-5032; 415-373-1642.

Some students enter Rice University with external fellowship support that provide stipends lower than the rate paid by Rice. The departmental policy is to supplement those fellowship stipends so recipients are not financially penalized.

MORE INFORMATION

Rice University: www.rice.edu
Office of Graduate and Postdoctoral Studies: graduate.rice.edu
Graduate Student Association: gsa.rice.edu
Explore Houston:
http://www.explore.rice.edu/explore/Houston1.asp
City of Houston: www.houstontx.gov
Houston Chronicle: www.chron.com
Greater Houston Partnership: www.houston.org