Rensselaer’s School of Science offers M.S. and Ph.D. programs in eight academic areas, preparing students for a wide variety of careers in the firmly established areas of mathematics and natural sciences and in the emerging fields of information science. Many students and faculty in science participate in interdisciplinary centers, including data science, fresh water studies, biosolar energy, terahertz waves, inverse problems, astrobiology, social and cognitive networks, scientific computation, and more. Students often undertake co-op programs with industry and research laboratories.

**Applied Mathematics, M.S.**
Areas include differential equations, asymptotic analysis, functional analysis, numerical analysis, mathematical programming, and applied geometry. Mathematical modeling and applications of mathematics in the physical sciences, biological sciences, and engineering are also emphasized.
Dawnmarie Robens
Graduate Coordinator
(518) 276-6414
math-program@math.rpi.edu
www.math.rpi.edu

**Applied Science, M.S.**
The Master of Science degree traditionally has been in a single subject, e.g., chemistry, physics, or mathematics. However, the working environment that college graduates face today, and will face in the future, is one in which their jobs increasingly bridge more than one area of specialization. The M.S. in Applied Science program, intended for working professionals, is based upon Rensselaer’s belief that science graduates of the past few decades and most current graduates need educational preparation for today’s interdisciplinary world. Options exist in many areas of science.

**Biochemistry/Biophysics, M.S., Ph.D.**
Research areas include cell motility mechanisms, bioenergetics, glycobiology, protein folding, focusing of the eye, cellular bioengineering, and biofluid mechanics. Structure, function, synthesis, folding, stability and purification of various proteins and nucleic acids are being studied by molecular modeling, NMR, ESR, fluorescent probes, proteomics, and molecular genetic techniques.
Jody Malm
Admissions Coordinator
(518) 276-2808
malmj@rpi.edu
www.rpi.edu/dept/bcbp

**Astronomy, M.S.**
See Physics description.
Nicole McQuade
(518) 276-8391
gradphysics@rpi.edu
www.rpi.edu/dept/phys

**Examples include bioinformatics, polymer science, and computational science.**
William L. Siegmann
Associate Dean
(518) 276-6905
siegmw@rpi.edu
www.rpi.edu/academics/interdisciplinary/appliedscience.html

**www.science.rpi.edu**
Biology, M.S., Ph.D.
Areas of research include cell, molecular, and developmental biology, genetics, neurobiology, cancer biology, stem cell biology, structural biology, bioinformatics, molecular and cellular biophysics, computational biology, bioenergetics, biochemistry, tissue engineering, microbiology, freshwater ecology, and environmental sciences. The program emphasizes interdisciplinary training, use of cutting-edge technologies, and close interactions between students and faculty.

Jody Malm
Admissions Coordinator
(518) 276-2808
malmj@rpi.edu
www.rpi.edu/dept/bio

Chemistry, M.S., Ph.D.
Research areas include analytical and bioanalytical chemistry, biochemistry/biophysics, carbohydrate chemistry, cheminformatics, computational chemistry, inorganic and bioinorganic chemistry, materials informatics, organic chemistry, organometallic chemistry, polymer and materials chemistry, surface science, and spectroscopy. Programs are designed to fit the needs of individual students.

Sharon Gardner
Admissions Coordinator
(518) 276-2140
derris@rpi.edu
www.rpi.edu/dept/chem

Computer Science, M.S., Ph.D.
Research is conducted in algorithms, artificial intelligence, bioinformatics, computer graphics, computer vision, computational finance, data mining, data science, database systems, distributed computing, including grids and clouds, machine and computational learning, network security, networking, pervasive computing, robotics, semantic web, simulation, social networks, software engineering, and tetherless/wireless networking. Entering students are expected to have a substantial academic background in computer science and mathematics. Previous research experience preferred.

Terry Hayden
Admissions Coordinator
(518) 276-8419
grad-adm@cs.rpi.edu
www.cs.rpi.edu

Geology, M.S., Ph.D.
Research areas include geochemistry, igneous and metamorphic petrology, structural geology, tectonics, geophysics, seismology, paleoceanography and micropaleontology, chemical hydrology, and river and lake pollution.

Karen Hardik
Admissions Coordinator
(518) 276-6474
ees@rpi.edu
www.rpi.edu/dept/ees

Mathematics, M.S., Ph.D.
Research areas include analysis, methods of applied mathematics, differential equations, dynamical systems, inverse problems, numerical analysis, mathematical programming, operations research, data mining, and applications of mathematics in the physical sciences, biological sciences, and engineering.

Dawnmarie Robens
Graduate Coordinator
(518) 276-6414
math-program@math.rpi.edu
www.math.rpi.edu

Multidisciplinary Science, M.S., Ph.D.
The School of Science offers graduate programs leading to a Master of Science or Doctor of Philosophy degree in Multidisciplinary Science. These degrees allow students, who have traditional discipline-oriented backgrounds, to function more effectively in academic, industrial, or governmental positions that are multidisciplinary in nature. Prior to admission to the program, each student must contact a faculty member at Rensselaer concerning the proposed multidisciplinary research and must demonstrate that financial support is available.

With the help of the faculty member, who will be the principal research adviser, each student must prepare a preliminary research proposal that clearly indicates why this research is suited for the multidisciplinary program instead of a departmental program.

William L. Siegmann
Associate Dean
(518) 276-6905
siegmw@rpi.edu
www.rpi.edu/academics/interdisciplinary/multidisciplinaryscience.html

Physics, M.S., Ph.D.
Astronomy, M.S.
Research areas include experimental and theoretical high energy and nuclear physics; experimental and theoretical condensed matter physics; computational physics; physics of surfaces, interfaces, epitaxial films, nanostructures, nanoparticles, and disordered materials; optical and electronic properties of artificial structures; ultra-fast and non-linear optical phenomena; terahertz spectroscopy; molecular and cellular biophysics; statistical physics and complex networks; astrophysics of interstellar matter and star-forming regions; astrobiology; structure, evolution, and dark matter in the Milky Way galaxy.

Nicole McQuade
(518) 276-8391
(518) 276-6127
gradphysics@rpi.edu
www.rpi.edu/dept/phys
Biology has been undergoing revolutionary changes in recent decades. Many problems once handled only descriptively are now analyzed at the molecular level using powerful combinations of biochemical, biophysical, genetic, molecular, structural, and computational tools. Rensselaer’s graduate programs tackle new basic research paradigms, applied biomedical research, as well as challenges for environmental resilience.

Biological Sciences

Biology is a broad-based department that encompass nearly every area of modern biology, including macromolecular structure and function, computational biology and bioinformatics, biochemistry and bioenergetics, nanobiology and biotechnology, cell and developmental biology, genetics of model organism systems, neuroscience, microbiology and host-pathogen interactions, molecular microbial ecology/evolution, synthetic biology, and freshwater ecology.

DEGREES OFFERED

- Biology B.S., M.S., Ph.D.
- Biochemistry and Biophysics B.S., M.S., Ph.D.
- Bioinformatics and Molecular Biology B.S., M.S., Ph.D.

In the last four years the department has awarded 320 B.S., 22 M.S., and 27 Ph.D., degrees.

THE JEFFERSON PROJECT AT LAKE GEORGE

Rensselaer, IBM, and the FUND for Lake George recently launched “The Jefferson Project at Lake George,” a multimillion-dollar collaboration with the goal of understanding complex factors threatening one of the world’s most pristine natural ecosystems. The world-class scientific and technology facility at Lake George aims to create a new model for predictive preservation and remediation of critical natural systems.

AFFILIATED RESEARCH CENTERS

- Rensselaer Institute for Data Exploration and Applications (IDEA)
- Center for Biotechnology and Interdisciplinary Studies (CBIS)
- Darrin Fresh Water Institute (DFWI)
Biological Sciences

FACULTY AND RESEARCH AREAS

PROFESSOR
Charles Boylen
Anthropogenic impacts on freshwater ecosystems, nutrient eutrophication, invasive aquatic species.

Jonathan Dordick
Howard P. Isennann Professor of Chemical and Biological Engineering and Vice President for Research
Protein-material interactions, biocatalysis in drug discovery and human toxicology, bioengineering, and nanobiotechnology.

Angel García
Professor of Physics and Senior Constellation Chaired Professor in Biocomputation and Bioinformatics
Theoretical and computational biology, protein folding, RNA folding, pressure effects in folding, protein-membrane interactions, antimicrobial peptides, protein aggregation, biomolecular dynamics and statistical mechanics.

Susan P. Gilbert
Department Head
Structure and mechanisms of microtubule-based molecular motors involved in cell motility and cytoskeletal dynamics.

Robert Linhardt
Ann and John H. Broadbent, Jr. ’59 Senior Constellation Professor of Biocatalysis and Metabolic Engineering
Bioactive carbohydrates, particularly the complex polysaccharide heparin, complex carbohydrates.

Brad Lister
Ecology and evolutionary biology, ecological impacts of climate change, computational ecology.

George Makhatazde
Constellation Professor of Biocomputation and Bioinformatics
Rational design of proteins for thermostability, functional protein dynamics, protein-protein and protein-ligand interactions, mechanism of adaptations to extreme conditions, bioinformatics, computer simulations of protein folding.

Sandra Nierzwicki-Bauer
Director of Darrin Fresh Water Institute (DFWI)
Molecular studies of microbial and picoeukaryote communities in lakes and rivers; basic and applied studies of invasive species (zebra mussels, Asian clams, spiny water flea), water resource management and environmental remote sensing.

ASSOCIATE PROFESSOR
Blanca Barquera
Sodium bioenergetics in pathogenic bacteria, mechanistic enzymology of respiratory proteins and ion transporters, membrane proteins, bacterial physiology.

Christopher Bystroff
Bioinformatics, protein design, computational biology.

Yuri Gorby
Electromicrobiology, microbial physiology, bioprocess engineering, and bioremediation.

Michael Hanna
Teaching innovations and communication of science to the general public.

To apply, learn more at www.rpi.edu/dept/admissions/graduate/
The Department of Chemistry and Chemical Biology offers a modern set of graduate programs and courses that reflect the growing impact of chemistry in 21st century science and engineering. In addition to offering a variety of dynamic and evolving research programs, our faculty are well grounded in traditional areas of chemistry, while embracing new interdisciplinary programs that transcend traditional boundaries.

In order to remain at the frontier of modern Chemistry and Chemical Biology, the department emphasizes rigorous instruction in the fundamentals of chemical synthesis, characterization and function using the most modern methods and equipment available to explore the boundaries and intersections between traditional fields of study. This dedication is illustrated by the number of interdisciplinary centers associated with the Chemistry and Chemical Biology Department—all of which involve significant bridges between Chemistry and other disciplines, departments, and schools.

**AFFILIATED RESEARCH CENTERS**
- Center for Biotechnology and Interdisciplinary Studies (CBIS)
- The Baruch ’60 Center for Biochemical Solar Energy Research
- Computational Center for Innovations (CCI)
- New York Center for Astrobiology
- New York State Center for Polymer Synthesis
- Rensselaer Exploratory Center for Cheminformatics Research
- Center for Data Science
- Materials, Devices, and Integrated Systems
- Icahn School of Medicine at Mount Sinai Hospital

**PARTNERSHIP WITH MOUNT SINAI**
The establishment of a formal relationship between Rensselaer and The Icahn School of Medicine at Mount Sinai has opened up new avenues of research collaboration in many interdisciplinary fields, many of which intersect strongly with programs in the Department of Chemistry and Chemical Biology. These include drug discovery technology, drug delivery, biocompatible materials, predictive toxicology, healthcare informatics, and more.
## Chemistry and Chemical Biology

### Faculty and Research Areas

**Chulsung Bae**  
Associate Professor  
Organic Chemistry, Polymer Chemistry, Green Chemistry

**Ronald A. Bailey**  
Associate Department Head and Professor  
Inorganic Chemistry

**Blanca Barquera**  
Associate Professor  
Biochemistry

**Curt M. Breneman**  
Department Head and Professor  
Physical, Organic, Computational Chemistry

**Wilfredo Colón**  
Professor  
Biochemistry, Biophysical Chemistry

**Steven Cramer**  
William Weightman Walker Professor  
Bio separations, Bioprocessing, Chromatography, Proteomics, Microfluidics, Multiscale modeling, Affinity precipitation, Biosensors

**James V. Crivello**  
Professor  
Organic, Polymer Chemistry

**Peter H. Dinolfo**  
Assistant Professor  
Inorganic Chemistry, Materials, Chemistry, Physical Chemistry

**James P. Ferris**  
Research Professor  
Biochemistry, Organic Chemistry

**Richard A. Gross**  
Constellation Chair, Biocatalysis and Metabolic Engineering; Professor  
Research at the interface between polymers and the biological sciences; biosynthesis, biocatalysis, and biotechnology.

**Gerald M. Korenowski**  
Professor  
Physical, Analytical Chemistry

**K.V. Lakshmi**  
Associate Professor  
Biophysical Chemistry, Biochemistry, Bioinorganic Chemistry, Physical Chemistry

**Robert J. Linhardt**  
Constellation Chair, Biocatalysis and Metabolic Engineering; Professor  
Biochemistry, Biophysics

**George Makhatadze**  
Chaired Constellation Professor in Biocomputation and Bioinformatics  
Biophysical Chemistry, Structural Biology

**Linda B. McGown**  
William Weightman Walker Professor  
Analytical Chemistry, Bioanalytical Chemistry, Environmental Analysis, Biotechnology

**James A. Moore**  
Professor  
Organic, Polymer Chemistry

**Marianne Nyman**  
Associate Professor  
Environmental Analytical Chemistry, Sediment Remediation, Fate and Transport of Hydrophobic Organic Compounds in Natural and Engineered, Systems, Aquatic Chemistry

**Chang Ryu**  
Acting Director, New York Center for Polymer Synthesis; Professor  
Physical, Analytical Chemistry; Polymers, Materials Chemistry

**Chunyu Wang**  
Associate Professor  
Protein NMR

**Mark P. Wentland**  
Professor  
Medicinal, Organic Chemistry

“*Our faculty are working on developing new clean systems for solar energy generation, environmentally sustainable chemistry, biotechnological applications to healthcare and medicine, as well as creating advanced materials with the aid of computational methods, among others.*” — Peter Dinolfo

To apply, learn more at  
[www.rpi.edu/dept/admissions/graduate/](http://www.rpi.edu/dept/admissions/graduate/)
Computer Science

Computer science is the study of the design, analysis, communication, implementation, and application of computational processes. At Rensselaer, education in computer science prepares students for solving applied real-world problems and for conducting research in computer science. The program provides students with a solid grounding in both theory and practice.

Students in Computer Science are exposed to applied areas such as robotics, databases, programming language design, and operating systems. Research areas include bioinformatics, computational science and engineering, computer vision, database systems, networking, parallel computing, pervasive computing, robotics, semantic web, software design, and theoretical computer science.

DEGREES OFFERED

Computer Science  B.S., M.S., Ph.D.
416 B.S., 109 M.S., and 49 Ph.D. degrees awarded over the last four years

AREAS OF GRADUATE RESEARCH

- Algorithms and theory
- Artificial intelligence
- Bioinformatics
- Computational finance
- Computational linguistics
- Computer networks
- Computer vision; biomedical image analysis
- Concurrent programming and cloud-based computing
- Data cyberinfrastructure
- Data mining
- Database systems; manufacturing applications
- Distributed and large-scale simulation
- Distributed systems
- Game theory
- Graphics and visualization
- High-performance and massively parallel computation
- Machine learning
- Program analysis and verification
- Robotics
- Semantic web and web science
- Security
- Social and cognitive networks
- Software engineering

RENSSLEAER INSTITUTE FOR DATA EXPLORATION AND APPLICATIONS (IDEA)

The new Institute brings together the wealth of data in high performance computing, web science, data science, network science, cognitive computing, and immersive technologies that are available at Rensselaer. It involves faculty and students across the five schools to address some of the most challenging problems facing our world today.

AFFILIATED RESEARCH CENTERS

- Center for a Digital Society
- Center for Computational Innovations (CCI)
- Data Science Research Center
- Landgraf Center for Computer Vision, Graphics, and Robotics
- Scientific Computation Research Center (SCOREC)
- Social Cognitive Networks Academic Research Center (SCNARC)
- Network Science and Technology Center
PROFESSOR

Francine Berman
Edward P. Hamilton
Distinguished Professor in Computer Science

Big data and data cyberinfrastructure, preservation and access, e-science, grid, parallel, and high performance computing.

Christopher Carothers

Massively parallel computing, parallel discrete-event simulation, systems simulations.

Mark Goldberg

Experimental design and analysis of algorithms, combinatorics and graph theory, applications to social networks.

Martin Hardwick

Data management systems for engineering and manufacturing applications.

Jim Hendler

Tetherless World Senior Constellation Professor

Artificial intelligence, semantic web, web science, agent-based computing, open government data, and high performance processing.

Malik Magdon-Ismail

Theory, algorithms and applications of computational learning systems, computational finance, bioinformatics, social and communication network analysis.

Deborah L. McGuinness

Tetherless World Constellation Co-Chair

Semantic web, intelligent systems, semantically enabled informatics, semantic e-Science.

David Spooner

Associate Dean for Undergraduate Education and Administration

Information security, computer science, and information technology education.

Charles Stewart

Department Head

Computer vision, biological and environmental applications.

Boleslaw Szymanski

Claire and Roland Schmitt Distinguished Professor, Director of the Center for Network Science and Engineering

Social, computer, and sensor networks; distributed and parallel computing; distributed simulation.

Jeff Trinkle


Bülent Yener

Director of Data Science Research Center

Computer networks, biological networks, bioinformatics, security, combinatorial optimization.

Mohammed Zaki

Data mining, machine learning, bioinformatics, complex graphs and networks, data science, high performance computing.

ASSOCIATE PROFESSOR

Sibel Adali

Social networking, trust, multimedia database systems, information integration, semantic web.

Elliot Anshelevich

Design and analysis of algorithms, strategic agents in networks, algorithmic game theory.

Barbara Cutler

Computer graphics, visualization, geometry processing, algorithms, design tools for architecture.

Petros Drineas

Design and analysis of algorithms, linear algebra algorithms and their applications in data mining.

Heng Ji

Edward P. Hamilton Development Chair

Natural language processing with an emphasis on the design of efficient algorithms to extract information from text.

Mukkai Krishnamoorthy

Programming environments, design and analysis of combinatorial algorithms, open source software development issues, network visualization.

Ana Milanova

Software engineering, compilers, program analysis, software testing, verification, reliable software systems.

Carlos Varela

Concurrent programming models and languages, adaptive scalable distributed computing, computational science and engineering

ASSISTANT PROFESSOR

Stacy Patterson

Clare Boothe Luce Assistant Professor

Theoretical foundations of dynamic distributed computation and networks, cooperative control, and signal processing.

Lirong Xia

Artificial intelligence, multi-agent systems, decision-making under uncertainty, algorithm design, social choice (voting) theory, game theory.
Earth and Environmental Sciences

In recent decades, the Earth Sciences have undergone major changes, stimulated in part by the reinterpretation of Earth history and processes within the context of plate tectonics. The past 15 years have been exciting, as new understanding of the interconnectedness among air, water, and solid Earth has come into sharper focus. We address key topics ranging from environmental contaminants in local waterways to the evolution of our planet.

The Department of Earth and Environmental Sciences offers the study of Earth’s component materials, the development of its structures and surface features, the processes by which these change with time, and the origin, discovery, and protection of its resources—water, fuels, and minerals. Our students use techniques ranging from seismological and satellite-tracking investigations of crustal motions to state-of-the-art geochemical instruments.

DEGREES OFFERED
Environmental Science  B.S.
Geology  B.S., M.S., Ph.D.
Hydrogeology  B.S.

EQUIPMENT & FACILITIES
- Electron Microscope Laboratory
- Corman Center for Mass Spectrometry
- Raman and Fourier Transform Infrared Spectroscopy
- Atomic Force Microscope
- High Pressure-Temperature Experimental Laboratory
- Lapidary Laboratory
- X-ray Fluorescence
- Geophysics Laboratory

MAJOR AREAS OF GRADUATE RESEARCH
- Environmental Geoscience
- Environmental Informatics
- Geochemistry of the Earth’s Interior
- Metamorphic Petrology and Tectonics
- Paleoceanography and Micropaleontology
- Solid-Earth Geophysics

NEW YORK CENTER FOR ASTROBIOLOGY

The New York Center for Astrobiology is devoted to investigating the origins of life on Earth and the conditions that lead to formation of habitable planets in our own and other solar systems. Supported by NASA, the center is a member of the NASA Astrobiology Institute (NAI), and is a partnership between Rensselaer and the University at Albany, Syracuse University, the University of Arizona, and the University of North Dakota.
Earth and Environmental Sciences

Faculty and Research Areas

Richard Bopp
Associate Professor
Environmental Geochemistry

Daniele Cherniak
Research Professor
Experimental Geochemistry and Accelerator Spectrometry

Peter Fox
Professor and Tetherless World Constellation Chair
Solar and solar-terrestrial physics, ocean and environmental informatics, computational and computer science, digital humanities, and distributed semantic data frameworks

Mimi Katz
Assistant Professor
Paleoceanography and micropaleontology

Laurie Leshin
Professor and Dean
Planetary science, astrobiology, meteoritics

Steven Roecker
Professor
Seismology, geophysics, tectonics

Karyn Rogers
Assistant Professor
Geochemical reaction energetics, geomicrobiology, and microbial ecology in extreme ecosystems; astrobiology and planetary habitability

Frank Spear
Department Head and Edward P. Hamilton Distinguished Professor
Metamorphic petrology, thermochronology, tectonics

Bruce Watson
NAS, Institute Professor
Transport properties, numerical modeling, kinetics, ion-beam analysis, ion implantation, inorganic geochemistry, high-pressure science, Earth fluids, early Earth, climate proxies.

To apply, learn more at www.rpi.edu/dept/admissions/graduate/
The Rensselaer Master of Science in Information Technology balances the study of management strategies and technology leadership with advanced course work in an IT concentration. Students complete a suite of core and capstone courses and also select three to five additional courses to complete their concentrations. Professional and research tracks are offered for the M.S. in IT degree.

**DEPTHS OF EXPERIENCE—THE IT CONCENTRATIONS**

Concentrations are designed to provide an in-depth experience in the application of information technology. Eleven concentrations are currently available.

- Data Science and Analytics
- Database and Intelligent Systems
- Financial Engineering
- Information Dominance
- Information Security
- Information Systems Engineering
- Human-Computer Interaction
- Management Information Systems
- Networking
- Software Design and Engineering
- Web Science

**AFFILIATIONS**

- Tetherless World Constellation
- The Rensselaer Institute for Data Exploration and Applications (IDEA)
- Advanced Multiprocessing Optimized System (AMOS)
Information Technology and Web Science

CAPSTONE COURSE

PROFESSIONAL TRACK

The M.S. in IT capstone course integrates the knowledge and professional practice of IT core and concentration courses. The capstone utilizes an Information Technology team project with a real organization to practice the major concepts of the IT master's degree. The team project involves strategic and business planning, systems development, and technology implementation. Expertise in database systems, data analytics, software design and engineering, decision sciences, management of technology, human-computer interaction, and ethics are applied within a framework of global IT strategy.

RESEARCH TRACK

Students also have the option to choose a Master's Project or Master's Thesis in lieu of the capstone course. The final project or thesis completion will demonstrate skills in one concentration as well as understanding of the five core areas of IT. The Master’s project is also expected to have some practical significance or application. Thesis papers will follow all the guidelines set out by the Office of Graduate Education. Students will work with a faculty adviser based on area of interest and are encouraged to read current journal articles or papers in their concentration. Once a topic for research has been determined, students will work closely with the faculty adviser to complete the project or thesis over two semesters.

ITWS CAREERS AND SALARIES

M.S. in IT Rensselaer graduates are heavily recruited by top companies with many graduates receiving multiple offers. Job titles of graduates includes Software Engineer, Information Technology Analyst, Application Developer, Technology Consultant, and Computer Programmer. Cisco, Capital One, Oracle, Amazon, IBM, Bank of America, and Capital IQ are just a few of the companies that hire M.S. in IT graduates. In December 2012, the average starting salary for graduates of the M.S. in IT degree was $84,000. The highest starting salary to date is $110,000.

FACULTY AND RESEARCH AREAS

Peter Fox
Director of Information Technology and Web Science; Faculty Leader for Data Science and Analytics Concentration
Solar-terrestrial physics, computational and computer science, information technology, and grid-enabled, distributed semantic data frameworks.

Roger Grice
Clinical Associate Professor of Technical Communication and HCI
Information usability, human-computer interaction, communicating on the WWW, usability testing and evaluation, analysis of computer games interfaces, effective teaching and learning in virtual classroom and designing the total user experience.

David Spooner
Professor and Faculty Leader for Information Security and Database and Intelligent Systems
Database security and Computer Science and Information Technology education.

Gregory N. Hughes
Founding Professor for the B.S. and M.S. degrees in Information Technology
Pursuing the latest trends in information technology, e-Business, and entrepreneurship.

Rick Plotka
Professor for the B.S. and M.S. degrees in Information Technology
Executive management, systems architecture, applications architecture, operations research management, project management, web systems development.

Carl Pavarini
Professor for the Management Core
Business issues for engineers and scientists.

Jim Hendler
Professor and Faculty Leader for the Web Science Concentration
Artificial intelligence, semantic web, agent based computing, high performance processing.

For a complete list of faculty and their research areas, visit itws.rpi.edu

To apply, learn more at www.rpi.edu/dept/admissions/graduate/
Through the centuries, mathematics has been a central feature of our intellectual and technological development. Today its role in the physical sciences and engineering is well established. Its role in the life and social sciences, medicine, management, and the arts is undergoing remarkable growth. Our focus is the study of mathematical and computational methods and their application to problems of significance to our society.

The department trains individuals in mathematics, both as a subject in itself and as a discipline to aid in the development of other social and scientific fields. The Department of Mathematical Sciences is one of the few in the country with a strong faculty orientation toward applications of mathematics. This emphasis is reflected in the many courses dealing with areas of mathematical applications, and in the applied flavor with which department faculty typically teach undergraduate courses.

### Degrees Offered

- **Mathematics**  B.S., M.S., Ph.D.
- **Applied Mathematics**  M.S., Ph.D.

In the last four years the department has awarded 154 B.S, 85 M.S., and 42 Ph.D. degrees.

### Major Areas of Graduate Research

- Acoustics
- Applied Geometry
- Approximation Theory
- Bioinformatics
- Biomathematics
- Chemically Reacting Flows
- Dynamical Systems
- Environmental Problems
- Fluid Dynamics
- Inverse Problems
- Machine Learning
- Math Education
- Mathematical Physics
- Multiphase Flows
- Nonlinear Analysis
- Nonlinear Materials
- Nonlinear Waves
- Numerical Analysis
- Operations Research and Mathematical Programming
- Optimization
- Perturbation Methods
- Scientific Computing

### Placement

The department has a strong record of placing Ph.D. students in prestigious postdoctoral positions at top-tier universities and labs, and in industrial positions.

### National Ranking

The Rensselaer Applied Mathematics graduate program is ranked #17 in the nation by U.S. News & World Report.
Mathematical Sciences

**Faculty and Research Areas**

**Kristin Bennett**
Professor
Mathematical programming, operations research, machine learning, data mining, artificial intelligence, applications of these methods to problems in engineering, business, medicine, biology, chemistry, and public health.

**Joseph Ecker**
Professor
Mathematical programming, multi-objective programming, geometric programming, mathematical programming applications, ellipsoid algorithms, linear and nonlinear bi-level programming.

**William Henshaw**
Professor
Margaret A. Darrin Distinguished Professor in Applied Mathematics
Numerical algorithms for partial differential equations, high-order accurate methods, approximations for adaptive and overlapping grids, fluid and solid mechanics, fluid-structure interactions, and electromagnetics.

**Isom Herron**
Professor
Applied mathematics, fluid mechanics, hydrodynamics; stability, biometrics.

**Mark Holmes**
Professor
Perturbation methods, biomathematics, nonlinear continuum mechanics

**David Isaacson**
Professor
Mathematical physics, biomedical applications, electrical impedance tomography.

**Ashwani Kapila**
Professor
Applied mathematics, fluid mechanics, multi-scale, multi-phase and multi-physics problems, scientific computation.

**Gregor Kovacic**
Professor
Applied mathematics, nonlinear dynamics, nonlinear optics, mathematical neuroscience

**Peter Kramer**
Professor
Modeling transport in turbulent flows, computer simulation of micro-physiological systems, stochastic modeling in physics and biology, multi-scale asymptotic methods, random field simulation, non-linear wave turbulence.

**Fengyan Li**
Associate Professor

**Chjan Lim**
Professor
Network science, non-equilibrium statistical physics, applied probability and stochastic process, vortex dynamics and quasi-two-dimensional fluid flows.

**Yuri Lvov**
Professor
Mathematical physics and nonlinear phenomena.

**Harry McLaughlin**
Professor
Applied geometry as it applies to design and manufacturing problems.

**Joyce McLaughlin**
Ford Foundation Professor of Mathematical Sciences; Director, Center for Inverse Problems (IPRPI)
Inverse bio-elasticity problems, inverse vibration and inverse scattering problems, wave propagation, analysis, applied mathematics.

**John Mitchell**
Professor
Optimization, integer programming, column generation, conic optimization, semi-definite programming, optimization problems with complementarity constraints, mathematical modeling of interdependent infrastructure systems.

**Bruce Piper**
Associate Department Head and Associate Professor
Computer-aided geometric design, numerical analysis, computer graphics

**Victor Roytburd**
Professor
Applied Mathematics, nonlinear dynamics in combustion, laser and nonlinear fiber optics, and reactive fluids

**Donald Schwendeman**
Department Head and Professor
Applied and computational mathematics, gas dynamics and wave propagation, multi-scale and multiphase reactive flow, mathematical modeling and computations in industrial applications

**William Siegmann**
Professor
Applied mathematics, wave propagation, acoustics.

**Michael Zuker**
Professor
Bioinformatics: development and implementation of algorithms to predict nucleic acid folding and hybridization by free energy minimization using empirically derived thermodynamic parameters

To apply, learn more at www.rpi.edu/dept/admissions/graduate/
Physics, Applied Physics, and Astronomy

Physics is the source of new concepts about the nature of the universe and is a driving force for new technologies. The fundamental physics research of one generation often leads to the applied physics and technology of the next. Rensselaer’s graduate program in physics conducts both fundamental and applied research, in collaboration with researchers from other departments, other universities, industry, or the national laboratories.

The Department of Physics, Applied Physics, and Astronomy prepares students to contribute to new concepts and technologies through innovative teaching methods that combine student-faculty interactions, computer-based education, and “hands-on” experience in modern laboratories.

DEGREES OFFERED

Applied Physics  B.S.
Astronomy  M.S.
Multidisciplinary Science  M.S., Ph.D.
Physics  B.S., M.S., Ph.D.

MAJOR RESEARCH AREAS

In all areas of research, problems are addressed using computational techniques. One-third of our faculty members conduct computationally driven research programs.

Astronomy and Astrophysics
• Astrobiology
• Chemistry of interstellar dust
• Galactic structure and evolution
• Magnetohydrodynamics

Biological Physics
• Complex systems and networks
• Protein folding and dynamics

Energy Research
• Energy harvesting, conversion and transfer
• Solid-state lighting

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• Lattice field theory
• Neutrino experiments

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• Plasmonic structures
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• Complex systems
• Molecular electronics
• Quantum molecular dynamics
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• Thin film morphologies and transport

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Theoretical and computational aspects of the structure, dynamics, and stability of biological molecules.

Shirley Ann Jackson
NAE, President

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Complex systems; social dynamics; transport, flow, and cascading failures in complex networks; population dynamics and ecological invasion.

Shawn-Yu Lin
Constellation Professor in Future Chips
Photonic crystals, plasmonics, nano and silicon photonics, solid state lighting, solar energy applications.

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R.P. Baker Distinguished Professor of Physics
Materials physics, thin film morphology and texture, nanostructures for energy and electronics applications.

Vincent Meunier
Gail and Jeffrey L. Kodosky ’70 Constellation Professor of Physics, Information Technology, and Entrepreneurship
Theory, modeling, and computer simulation in nanoscience, including energy storage, electronic transport properties and materials.

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Experimental nuclear and particle physics; scientific computation.

Saroj Nayak
Study of atomic and electronic structures of matters.

Heidi Jo Newberg
Structure and dark matter distribution of the Milky Way galaxy, using MilkyWay@home, SDSS, and LAMOST.

Peter Persans
Department Associate Head
Optical and structural properties of amorphous, nanocrystalline, and quantum dot semiconductor materials.

Wayne Roberge
Astrobiology, multifluid magnetohydrodynamics, interstellar shock waves; physics of dusty plasmas.

John Schroeder
Glass and nanoparticle physics; cataract studies in human lenses.

Michael Shur
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THz electronics, physics of semiconductor materials and devices, color rendition; deep ultraviolet light emitting diodes.

Paul Stoler
Properties of hadrons; neutrino physics.

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Growth mechanism of oblique angle deposited nanostructures and films for energy applications.

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Composition and evolution of interstellar matter; organic inventories of protoplanetary disks; infrared astronomy; astrobiology.

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ASSOCIATE PROFESSOR

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Ultrafast and THz spectroscopy, sources and detectors of THz radiation.

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Structural and electronic dynamics in condensed matter; nonlinear THz and picosecond acoustic spectroscopy of nanomaterials.