

RESEARCH at RIT

The Rochester Institute of Technology Research Report

Spring/Summer 2012

SPOTLIGHT ON

COLOR

The Science of Color

Women in STEM—
A Systemic Issue

Pollution Prevention

Blazing a Trail of
Artistic Innovation

R·I·T

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RESEARCH at RIT

The Rochester Institute of Technology
Spring/Summer 2012

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The Past, Present, and Future of Research at RIT

RIT has a long history, but our current status as an internationally recognized research university is a relatively recent occurrence. That transformation is built on our foundation of excellence in applied research, industry partnerships, and our unique research and education programming in engineering, computer science, deaf education, and the arts. At the same time our faculty and students are pioneers in new and emerging fields that are helping to define the future of research and scientific inquiry.



Over the last two decades RIT has gone through a remarkable metamorphosis. The university has evolved from a highly regarded technical institute focused on teaching to a comprehensive

research university with internationally recognized programs in a wide range of fields. This includes being ranked by *U.S. News & World Report* as number two in the nation in graduate programs for game design, and being named one of the top 40 design schools in the world by *BusinessWeek*.

RIT's efforts to build on this tremendous transformation while honoring its traditional strengths is the focus of the 9th issue of *Research at RIT*. We highlight the development of our current research infrastructure and showcase several areas of focus that illustrate the past and present of scholarship on campus.

A team of researchers in the Munsell Color Science Laboratory is building on 25 years of work in color perception, modeling, and image appearance to redefine applications and development

in the field. This includes working with the Museum of Modern Art to image Vincent van Gogh's *Starry Night*, while also conducting novel research in the emerging field of computational photography.

This edition also promotes the university's efforts to improve the participation of women and minorities in STEM disciplines through multidisciplinary research and a host of campus-wide outreach initiatives. Finally, we spotlight our innovative work in pollution prevention and celebrate the past and future of artistic creation through a profile of the School for American Crafts.

I value your feedback and support as we continue to expand research on campus. Please feel free to contact me regarding these stories or other issues related to research at RIT.

Enjoy the breadth and the depth of Research at RIT!

Best Regards,

A handwritten signature in black ink that reads "Ryne Raffaelle". The signature is fluid and cursive.

Ryne Raffaelle, Ph.D.
Vice President for Research

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RIT has a century-long tradition of preparing students for successful careers and partnering with business and industry on applied research. Over the last decade, the university has developed a broad sponsored research portfolio and a reputation as a comprehensive research university.

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The New York State Pollution Prevention Institute (NYSP2I) is advancing research, development, and outreach that focuses on meeting the three principles of sustainability—people, planet, and prosperity—while also improving environmental quality and enhancing the productivity and competitiveness of New York state businesses.



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Women in STEM— A Systemic Issue

RIT has sought to study the educational and cultural factors that are causing the limited participation of women in Science, Technology, Engineering, and Math (STEM) fields. The university is also developing programs that can encourage female participation in these STEM disciplines.



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Blazing a Trail of Artistic Innovation

The School for American Crafts is the oldest craft school in America and has long been one of the leading creative and educational forces in the Arts and Crafts Movement. Artists Juan Carlos Caballero-Perez, Andy Buck, Jane Shellenbarger, and Robin Cass exemplify the school's dual mission to honor the American craft tradition and develop innovative methods for creating and presenting art.

Research Awards and Honors

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RIT's faculty, staff, and students have received significant national and international recognition for their research in a host of fields. A summary of awards and honors is provided.

On the Cover



RIT's Munsell Color Science Laboratory works with art conservators from around the world to improve the digital imaging of iconic artwork, such as *Starry Night* by Vincent van Gogh, shown on the cover in mid-measurement using a scanning linear light source.

Growing a Culture of Innovation

by Kathy Lindsley

RIT has a century-long tradition of preparing people for successful careers and partnering with business and industry on applied research. At the turn of the new century, the university began to focus on growing sponsored research. The efforts are having a profound impact on the university.

Creating a Research Environment

In 2002, RIT honored the first members of the Million Dollar PI Club: nine individuals who had received sponsored research awards totaling \$1 million or more. Ten years later, there are 72 research millionaires. A university-wide focus on sponsored research is producing measurable results. More evidence: In 1998, just 102 research proposals were submitted to funding organizations. Last year, 653 proposals were submitted—an increase of 540 percent.

Research activities flourish in all nine colleges as well as interdisciplinary research centers, and the university is increasingly involved in high-level funding programs and competitive grant initiatives. RIT has received awards from agencies including the National Science Foundation, National Institutes of Health, NASA, Department of Defense, and Department of Education, as well as numerous foundations and industry sponsors.

Last year, RIT received \$52.5 million in new research awards, including \$13.1 million toward construction of a facility for the Golisano Institute of Sustainability from the National Institute of Standards and Technology—the largest competitive federal award in RIT’s history. In addition, a recent \$1.75 million grant from the William G. McGowan Charitable Fund

will help construct a facility designed to foster innovation, research, and entrepreneurship among deaf and hard-of-hearing students and their hearing peers.

“Sponsored research at RIT has grown at an incredible rate over the last decade,” says Ryne Raffaele, vice president for research. “We focused on areas of strength where we could differentiate ourselves from other universities, and we’ve done a remarkable job.”

Early Days of Sponsored Research

One of RIT’s pioneers in this arena is imaging scientist John Schott, the Fredrick and Anna B. Weidman Professor in the Chester F. Carlson Center for Imaging Science. When Schott joined the faculty 30 years ago, virtually no sponsored research was being conducted and the university had no formal procedures for obtaining and administering grants, and no staff to facilitate the process.

Schott, who wanted to do research as well as teach, established the Digital Imaging and Remote Sensing Laboratory and also spearheaded development of RIT’s first doctoral degree program. The imaging science Ph.D. was launched in 1988.

“It’s hard to get started” in sponsored research, Schott says. “The way you get successful is to write a lot of proposals, and go through a lot of rejection. It feels

like getting kicked in the teeth. Faculty have big egos, and that’s tough.”

The Office of the Vice President for Research, an umbrella for university-wide research activities, was established in 2005 to support faculty and staff in their scholarship efforts. Recently, the university has created several seed funding programs and initiatives to assist faculty in increasing their research portfolio. These include the Principal Investigators Institute, which provides instruction and training on proposal writing, grant management, and research compliance. The annual Trustee Scholarship Award, created in 2005, and individual college awards established just this year, recognize faculty for outstanding scholarship, research, and creative work.

RIT’s strategic plan for 2005–2015 embraces faculty research as a key component of scholarship. The goal was not to transform RIT into a research university, says former president Albert J. Simone. “The plan incorporated the idea that RIT would be a teaching university which did significant research—especially applied research.”

As Provost Jeremy Haefner says, “The RIT faculty enthusiastically embrace the notion that they should bring their scholarship into their teaching and their teaching into their scholarship. RIT students

1937

RIT acquires the Empire School of Printing, which becomes the Department of Publishing and Printing.



1950

The School for American Craftsmen moves to RIT.

1951

With the establishment of the Graphic Arts Research Center, RIT becomes a center for research on all aspects of the graphic arts.



1965

RIT is selected by Congress as the site for the National Technical Institute for the Deaf. The first students enter NTID in 1968.



thrive in an environment where they are exposed to the thrill of discovery, creation, and innovation. Everyone involved is enriched by these collaborations.”

The launch of five new doctoral programs since 2002 (microsystems engineering, computing and information sciences, color science, sustainability, and astrophysical sciences and technology) has opened new avenues for exploration.

“RIT has created distinctive, interdisciplinary programs,” says Raffaella. “It sets us apart from other universities.”

Partners in Progress

The growth in sponsored research has evolved out of RIT’s long-standing tradition of partnering with industry and government. About 15 to 20 percent of RIT’s annual research funding comes from industry. This ratio is more than three times as much as the university’s peer institutions, reflecting RIT’s close ties with industry.

RIT has launched several programs aimed at working with industry:

- **First in Class:** Launched in 2000, the program was conceived to strengthen ties with companies, provide financial support for research, enhance the learning environment in the classroom, and afford opportunities for undergraduate and graduate students outside of the classroom, says Simone.

- **Corporate R&D:** More recently, President Bill Destler established RIT’s Corporate R&D program. It seeks to enhance technology transfer between academia and industry by allowing businesses to retain rights to intellectual property generated from company-defined research.

One current challenge faced by researchers is the economy. The availability of research funding edged down slightly for the past two fiscal years, but Raffaella remains optimistic.

“In today’s economy, funding agencies have become much more applied, which plays to our strengths,” he believes. “Our ability to compete is better than it’s ever been.”

RIT’s first Ph.D. recipient, Robert Loce ’85, ’93 (BS photographic science, Ph.D. imaging science), concurs. “The money goes where there is a track record of useful, practical successes,” says Loce, principal scientist and technical manager, Xerox Research Center. “The research funding growth at RIT speaks to the ability of the RIT community to deliver research of value and as promised”

One thing is certain: RIT researchers will never run out of ideas. Some come from the outside, from sponsors seeking solutions to problems. Others come from RIT scientists, as their work leads in new directions.

The world’s a complicated place,” says Schott. “We’re trying to understand it. And in the process, we’re teaching the next generation of researchers.”

A Timeline of Research

RIT’s tradition of applied research has greatly expanded over the past two decades as the university focuses on seeking sponsored research opportunities.



2011
RIT receives a \$13.1 million grant from the National Institute of Standards and Technology for construction of a facility for the Golisano Institute for Sustainability.

2010
Vignelli Center for Design Studies opens. The facility serves as an international hub for design education, scholarship, and research.

2008
RIT President Bill Destler unveils a new Corporate Research and Development program.

2007
Golisano Institute for Sustainability is established with a \$10 million commitment from Rochester businessman B. Thomas Golisano.

2002
A Ph.D. program in microsystems engineering, the first in the U.S., is launched, followed by doctoral degree programs in computing and information sciences (2005), color science (2007), sustainability (2008), and astrophysical sciences and technology (2008).

2000
The First in Class Initiative is launched, aimed at promoting collaboration with industry and government in applied research and product development.

2001
RIT establishes the NanoPower Research Laboratories to capitalize on the potential of nanomaterials in the areas of energy conversion, transmission, and storage.

2001
The IT Collaboratory, created through a \$14 million competitive grant from New York state in partnership with University of Buffalo and Alfred University, is formed. The center focuses on research in microsystems, photonics, remote sensing, and nanomaterials.

2001
RIT is selected by the Alfred P. Sloan Foundation to establish a printing industry center, one of 19 Sloan Industry Centers nationwide.



1986
The Center for Microelectronic and Computer Engineering opens. The facility is a center for undergraduate education and research in design and fabrication of integrated circuits.

1980
RIT Research Corp. formed, a subsidiary designed to provide business, government, and other organizations with applied research and consulting services.

1988
The Chester F. Carlson Center for Imaging Science is dedicated. Imaging science was an early area of sponsored research at RIT.

1988
RIT launches its first Ph.D. program, in imaging science. Xerox research scientist Robert Loce is the first graduate.

1997
The Center for Integrated Manufacturing Studies, supported by state and federal grants, opens with a mission to assist industry through research and training.





Revolutionizing Color Science:

Roy Berns, Mark Fairchild, and Jinwei Gu of RIT's Munsell Color Science Laboratory measure color, texture, gloss, and translucency to improve image appearance and gauge human perception to understand why materials look the way they do. Above, the team uses patented camera technology to capture a digitally enhanced representation of the artwork. Through projects in digital art reproduction, 3D visualization, and computational photography, the Munsell Lab is pushing the boundaries of color science.

The Science of Color

by Susan Gawlowicz

VIDEO LINK



RIT's Munsell Color Science Laboratory is in the business of decoding appearance, measuring color, texture, gloss, and translucency, and gauge perception to understand why materials look the way they do. Perception experiments quantify the human response to appearance, reducing it to mathematical models that feed back into our broader understanding of the science of color.

Combining the Real and the Digital

"We're one of the few labs in the world that is doing all of this, particularly the idea of not just using physical parameters as metrics but adding in the last step, to have people look at the results and ask, 'Are we really measuring what we think we are measuring?'" says Roy Berns, the Richard S. Hunter Professor in Color Science, Appearance and Technology, and director of the Munsell Color Science Lab. "Measuring our chromatic world and relating it to the human experience through mathematical modeling is the backbone of color science at RIT."

In 1985, the master's degree program in color science and the Munsell Color Science Laboratory moved into the new Chester F. Carlson Center for Imaging Science. The young program centered around Berns and Mark Fairchild, now associate dean for research and graduate education in the College of Science, whose research put RIT on the color science map.

"The Munsell Lab has a long history and a distinguished reputation in color science," Berns says. "Being the only color science graduate program in the U.S., and being here for so long, it really has populated the field. Anywhere you go now having to do with color science, you'll run into someone who has a connection with RIT."

In 2007, RIT added a doctoral program in color science. The addition of two faculty members—Jim Ferwerda and Jinwei Gu—brought a new dimension to the Munsell Lab. Ferwerda, who arrived in 2007 with a strong background in computer graphics, is pushing the limits of what's possible with display systems and three-dimensional visualization. Gu, who came on board in 2010, moves the department further toward computer science with computational photography—a blend of computer vision and computer graphics.

"The four of us complement each other," Fairchild says. "Jim and Jinwei bring some new things that Roy and I wouldn't have done on our own, but yet they are not so completely different. It's four different approaches on similar topics."



Before



After

Restoring *The Bedroom*: Working with the conservation, curatorial, and imaging departments at the Van Gogh Museum in Amsterdam, Roy Berns assisted in the digital reconstruction of *The Bedroom*, bringing back the colors that Van Gogh described to Paul Gauguin as "walls of pale violet . . . the doors lilac." (Reproduced with permission from the Van Gogh Museum.)



Rediscovering *Starry Night* Munsell scientists Dave Wyble, Roy Berns, and Tongo Chen partner with the Museum of Modern Art to develop new methods to image their stellar collection such as Vincent van Gogh's iconic painting *Starry Night*.



Imaging the Golden Gate Bridge with HDR: Mark Fairchild captured the dynamic range of the Golden Gate Bridge and San Francisco from the Marin Headlands as part of his High Dynamic Range (HDR) Photographic Survey.

From Van Gogh to Seurat

Berns' research efforts include color and imaging science projects in support of art conservation and also the documentation of national treasures. He has developed novel imaging techniques for museums, funded principally from the Andrew W. Mellon Foundation, and patented a multispectral camera system to make high-color-accuracy image archives.

Berns is active in what he calls "digital rejuvenation," in which images, such as Vincent van Gogh's *The Bedroom*, are produced simulating the original appearance of paintings and drawings that have changed dramatically in color over time. In 2003-2004, Berns led a team of conservators and photographers in creating a full-sized printed digital simulation of Georges Seurat's *A Sunday on*

La Grande Jatte for the Art Institute of Chicago's exhibition, "Seurat and the Making of *La Grande Jatte*."

More recently, Berns imaged Vincent van Gogh's *Starry Night* at the Museum of Modern Art. Berns used two different systems and his patented camera approach to mathematically derive information about the painting's color, surface topography, and gloss.

"Combining all this information gives us the ability to do the computer graphics on *Starry Night*, so that you can now start to look at it from different angles on your display," Berns says. "You can look at the topography or the three-dimensionality. So we have this system that enables us to look at *Starry Night* as a 3D object in space. No one has ever done this kind of imaging work on paintings of this size."

High Dynamic Range Imaging

Berns' work overlaps Fairchild's interest in High Dynamic Range (HDR) imaging. HDR allows for the imaging of a greater dynamic range between the lightest and darkest areas of an image, providing greater detail and imaging data than traditional technologies.

The team is currently working to merge Liquid Crystal Display (LCD) technology which is used in flat panel displays, with HDR to create novel imaging systems.

The team starts by prying open LCDs, removing the uniform light and replacing it with a projector. The HDR display creates an intensity of lights and darks by layering an image upon itself in a process known as "double modulation." The projected image overlaps and enhances the scene on the LCD display.

"The two images multiply so the dynamic range increases by that multi-



Digital Painting: Jim Ferwerda bridges the gap between the real and digital worlds with his tablet-based digital painting application. “TangiPaint” simulates brushstrokes and texture and allows the artist to manipulate surface orientation and lighting.

The Real and Digital Worlds: The TangiPaint system represents a first step toward developing digital art media that look and behave like real materials. Ferwerda, right, developed TangiPaint along with Ben Darling, a current graduate student in color science.

plication,” Fairchild says. “It’s as though you’re looking at a projector head on.”

Fairchild spent six months traveling the United States, collecting HDR images. He shot nine separate exposures of each scene, from overexposed to underexposed, capturing bright to dim light and everything in between.

“The high dynamic range takes all of these together and uses the best information out of each image to make one that includes the whole range of light,” he says.

Fairchild collected content as resource material and published the results in *The HDR Photographic Survey* in 2008.

“It’s not just a matter of capturing it, but a matter of how to render it, how to put it on a display or a piece of paper,” he says. “That’s where our research came in.”

Creation, display, and perception of moving images also intrigue Fairchild, who’s developing a research program

that could hold potential applications in the entertainment industry. He is exploring spectral imaging in digital cinema with David Long, assistant professor in RIT’s School of Film and Animation and a doctoral student in color science.

Dolby Laboratories supported some of Fairchild’s early digital cinema research and hired imaging science alumnus Mahdi Nezamabadi, who did his doctoral work with Berns on compression and picture quality. Interest in this area is growing. Fairchild and scientists at Technicolor are discussing a new project on human perception of displays in cinema.

“Work with corporations like Sony, Dolby, and Intel has laid the groundwork for ongoing research that examines how fundamental properties and limitations of the human visual system can be exploited to create more compelling visual experi-

ences in cinema with more realistic color appearance,” Fairchild adds.

Modeling Appearance

Fairchild spent part of 1998 on sabbatical at Cornell, where he first met Ferwerda, now the Xerox Endowed Chair in the Center for Imaging Science. Ferwerda has brought to the Munsell Lab his expertise in computer graphics and in modeling properties of appearance—color, gloss, texture, and translucency.

“We have a scientific foundation, which includes physical measurement, mathematical modeling, rendering, and perception, and trying to understand the connection between the physical side of things and the perceptual side of things—the appearance,” Ferwerda says. “The clear next steps from color are into a more comprehensive study of appearance.”

Ferwerda’s work quantifying gloss



Appearance Capture Through Computational Illumination:

Computational illumination utilizes optimal coded illumination patterns to capture unconventional but information-rich images of real-world objects, which can then be “decoded” via computation. Jinwei Gu uses the technology in his LED-based multispectral dome, which uses coded illumination to recover geometric and material data to more efficiently sort scrap metals for recycling.

perception has led to connections with people in industry and research for General Motors, Sherwin-Williams, and Hewlett Packard. His graduate student Alicia Stillwell is currently working on a project for Corning to determine how anti-reflection and anti-glare surfaces for displays impact image quality.

Advanced display systems are another area of interest for Ferwerda. He is using mobile devices, such as laptops and iPads, to create “tangible displays” that know their orientation in the environment.

“It responds to light the same way a real surface would,” Ferwerda says.

His custom apps produce images that simulate changes in surface lighting and appearance on a display screen. TangiPaint, for instance, is a digital painting application that allows the user to create digital paintings with simulated properties of oil paintings—impasto, texture, and gloss.

Advancing Computational Photography

Gu joined the color science program after completing his doctorate in computer science at Columbia University. An interest

in computer games led him to computer graphics and computer vision and the quest for photo-realistic imagery. He grew enamored of the physics of surface reflection and the interaction of light with different objects. His doctoral research led him to discover the Munsell Lab.

Gu gravitates toward research problems that detour from traditional color science topics like textiles and paints. An article about sorting and classifying materials for recycling using expensive and slow machines inspired him to develop a computer imaging system that automatically separates scrap metals for recycling based on light reflected off the material.

“My current research is focused on appearance capture,” Gu says. “How are you going to use computational cameras and computational illumination sources to efficiently measure reflectance and three-dimensional shapes?”

Gu is currently developing a novel camera for Xerox that controls the exposure of each individual pixel for high-speed imaging.

“In this project, we developed a coding scheme where after you capture an

exposure-coded image and it is decoded, you can recover a video from a single frame,” he says. “Pixels that capture an event have different time. We are sampling space-time volume more efficiently than with regular cameras.”

The Future of Color

Research at the Munsell Color Science Laboratory has evolved from a traditional focus on the appearance of a single color to include entire scenes.

The efforts of Berns, Fairchild, Ferwerda, and Gu seek to combine a wide variety of techniques to create new ways of examining color and redefine the field as a whole.

“What we’re doing now is to try and make measurements and models that are dealing with all these things as a kind of gestalt,” Berns says. “And that’s a new paradigm.”

On the Web

For more information about color science at RIT visit www.cis.rit.edu/mcsl.

Setting the Standard for Print Quality



Robert Chung

The School of Print Media's current research focus is in the areas of color management, process control, and printing standardization. The needs of industry drive the research agenda conducted by RIT faculty and students.

"We monitor what the printing industry is doing, but RIT leads in many ways," says Bob Chung, Gravure Research Professor in RIT's School of Print Media.

Less than a year ago, RIT, led by Chung, launched the Printing Standards Audit Certification, which is a rigorous, objective process for assessing a printer's ability to operate a standards-compliant workflow. These workflows are fundamental to creating efficient print supply chains and building trust between printers and their customers.

"We felt we needed to serve the North American printing industry," says Chung. "The next phase is to share our methodology with partners in Europe and Asia."

Chung wears several hats—advising RIT graduate students about print media related

thesis projects while also representing the U.S. as an expert of the International Standards Committee responsible for developing a new ISO standard defining requirements for a printing quality management system.

"I relay the problems and challenges facing the printing industry to RIT and work with graduate students who conduct research in some of these areas that need to be addressed," Chung adds. "It's a nice synergy because I am able to find a match with industry needs and student research projects. The outcomes are reflected in the students' published work."

Test Targets Volume 10 is the latest publication produced by the school's students, faculty, and industry professionals featuring technical papers on printing standardization and conformity assessment, the effects of paper containing optical brightening agents, ink verification, and a comparison of press calibration methods. *Test Targets* is an annual publication that is often utilized as a vehicle to reveal the latest printing trends. In *Test Targets Volume 9*, in collaboration with Eastman Kodak Co., RIT demonstrated how the Kodak Prosper 5000XL press closely matched standard offset printing.



Test targets, such as the version shown above, are used to assess color appearance and print quality of prepress and printing technologies. Robert Chung is developing uniform print quality management standards to enhance test targeting in improving printing techniques.

"We worked with Kodak when the commercial inkjet technology was still in its infancy and secrecy. It was exciting because people could see the public debut of the Kodak Prosper System and RIT benchmarked the results side-by-side, showcasing how inkjet printing measures up to traditional offset printing."

Improving Diagnosis Through Imaging



Christye Sisson

An RIT team is seeking to improve the diagnosis and assessment of psoriasis through the creation of a multimodal, image-based analysis system. The project seeks to improve treatment

for individual patients and allow for enhanced longitudinal studies of psoriasis.

"Presently, dermatologists use a method called the Psoriasis Area Severity Index (PASI) score to analyze affected areas of the skin," notes Christye Sisson, professor of biomedical photography at RIT and leader of the project team. "However, the process can be very subjective as each dermatologist could potentially 'grade' patients differently."

The lack of empirical data can make it difficult to compare assessments made by different dermatologists or by different research groups studying the disease.

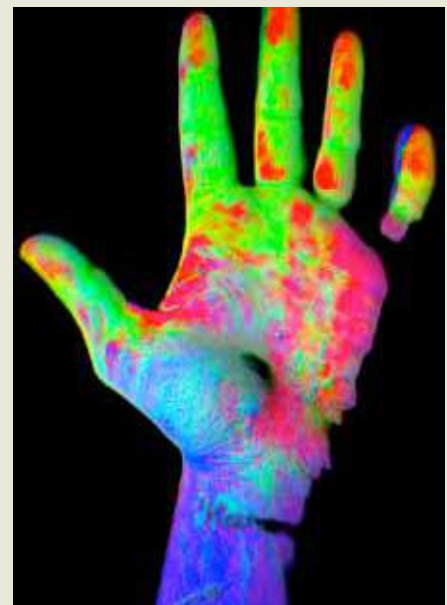
"Through the use of novel imaging technologies we are seeking to create a standardized and repeatable process that will be more accurate and allow for better assessment across populations," Sisson adds.

Sisson is working with Francisco Tausk, MD, a professor of dermatology at University of Rochester Medical Center, to create an imaging tool based on anomaly detection software which has previously been used in remote sensing applications. The tool will include multiple imaging modalities and assess the area of coverage based on the three criteria currently used by the PASI score: thickness, redness, and scale.

The team is currently testing imaging techniques, including thermal, ultra violet reflectance, and LIDAR, to identify the best method for assessing each criteria. They will then work with the University of Rochester to assess severity on current psoriasis patients and compare it to the PASI scores for each person.

Sisson and Tausk hope to ultimately create a standardized multimodal imaging system that could be implemented by dermatologists and hospitals nationwide.

"By modifying imaging technology that has already been developed we can create a repeatable, quantifiable method for diagnosing and ultimately treating patients with this disease," Sisson says.



A multi-modal image-based analysis system is being developed by a team of RIT researchers to improve the diagnosis of psoriasis. This includes the use of thermal imaging, shown above, to assess areas of coverage on the skin.

STEM Diversity: A Challenge and an Opportunity:

A current and a future engineering student conduct an experiment in the Toyota Production Systems Laboratory. Today, women hold only 24 percent of STEM jobs in the United States; this lack of diversity has been shown to limit the development of new technologies and innovations. Through a host of research and outreach activities, RIT is dedicated to improving education and training for female STEM students, ultimately making computing, science, math, engineering, and technology fields more diverse and more innovative.



Women in STEM—A Systemic Issue

by William Dube

According to the U.S. Department of Commerce, women hold only 24 percent of the Science, Technology, Engineering, and Mathematics (STEM) jobs in the United States although they hold 48 percent of all U.S. jobs. Similarly, women receive only 20 percent of bachelor's degrees in physics, engineering, and computer science awarded in the U.S. This shortfall in prospective STEM graduates limits the available resources for new technology innovation in the U.S.

Addressing the Problem

Diversity in the STEM workforce and its impact on society is an increasingly important issue for educators, business leaders, and policy makers, particularly as the U.S. faces increasing pressure from our international competitors.

“Numerous studies have shown that the most creative and innovative ideas derive from teams that are highly diverse,” notes Harvey Palmer, dean of RIT’s Kate Gleason College of Engineering, the only engineering college in the nation named in honor of a female engineer. “Furthermore, women represent half of the intellectual capital in our society as well as half of all those who depend upon the myriad products and services that comprise the global economy.”

“The systemic underrepresentation of women and minorities in STEM disciplines in the U.S. hampers our ability to develop new ideas and new ways of addressing scientific and technological challenges,” adds Sophia Maggelakis, professor of mathematics and dean of RIT’s College of Science. “At RIT, we have sought to study the educational and cultural factors that have exacerbated this problem and to develop programs that can encourage female participation in STEM disciplines.”

These efforts include research projects on the educational and workplace environment for female scientists and engineers as well as the development of outreach programs that seek to encourage interest in science and math among women and girls at all levels, from the elementary and secondary level to college.

Changing the Culture

“A key factor in the underrepresentation issue is the classroom environment,” notes Laura Tubbs, professor of chemistry and associate dean of the College of Science. “As an example, research has shown that in classes, at all levels of education, boys are called on more often and are given more leeway for wrong answers. This can enhance negative stereotypes, such as boys are better at math, and create a negative learning environment for girls and women.”

Tubbs led one of the first programs in the nation designed to provide teacher training and mentoring to impact the

STEM classroom environment for women and girls. She has since developed a series of workshops and professional development modules designed to promote equal gender treatment in the classroom.

Funded by the National Science Foundation, the initial project provided training for a group of RIT STEM professors and science and math teachers and guidance counselors from local high schools on their teaching and mentoring practices. In addition, the team interviewed female students, in multiple age groups, to gauge potential barriers for female learners and compare teacher and student impressions.

“As we went through this process, all of the teachers involved, myself included, were really shocked at how unequal our classroom environments were,” Tubbs says. “Teachers were often unaware of how their actions impacted female students. Even seemingly normal classroom interactions, such as asking for answers by a show of hands, were shown to favor male students.”

The research led to the creation of a series of workshops designed to enhance the use of teaching methods that address



A Decade of Effort: For the past 10 years, RIT has focused on increasing diversity in its STEM student body, to promote an environment of inclusion on campus, and to produce future generations of engineers and scientists who properly model the population as a whole.



The Classroom Environment: RIT professor Laura Tubbs conducted one of the first programs in the nation designed to improve the college classroom learning environment for women and girls. This included illustrating how normal class interactions, such as asking for a show of hands, tend to favor male students.

gender bias. Tubbs has also worked with the College of Science and the Division of Academic Affairs to create classroom training modules for use in the university’s new faculty orientation and professional development activities.

“Laura’s work in this area has assisted the college in creating a better environment for our female students, which has helped improve recruitment and retention,” Maggelakis adds.

Analyzing Self-Efficacy

Additional RIT research has sought to assess factors outside the classroom that can create a positive environment for STEM female students.

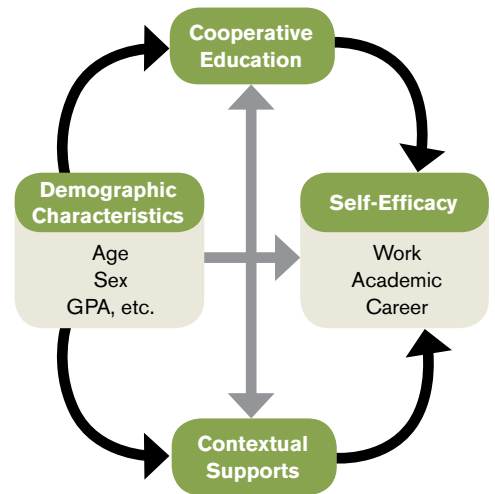
Margaret Bailey, professor of mechanical engineering and faculty associate to the provost for female faculty, is working with a multi-university team to assess the impact of work experience, including cooperative education and internships, on self-efficacy and retention, particularly among female engineering college students.

“Self-efficacy—a person’s belief in his

or her own competency—is seen as a key factor in academic success and in future career achievement,” notes Bailey. “By analyzing the impact of co-op on self-efficacy we hope to enhance understanding of how it can be used as a tool to improve confidence, self-awareness, and overall academic success.”

Through a three-year grant from the National Science Foundation, the team is surveying students in undergraduate engineering programs at four universities: Northeastern, RIT, the University of Wyoming, and Virginia Tech. They are assessing work, career, and academic self-efficacy between male and female students and between those who have had co-ops or internships and those who haven’t.

Initial findings show that prior to co-op, male students have higher academic self-efficacy than their female counterparts, even among those with similar grade-point averages. In addition, women surveyed indicated that they gained more from the use of support services, such as mentoring, academic advising,



Improving Self-Efficacy and Retention: Margaret Bailey is part of a multi-university team that is seeking to analyze the use of cooperative education as a tool for improving self-efficacy and retention among female college engineering students.

and membership within professional societies. Female respondents also reported higher levels of career self-efficacy, which involves their ability to self-appraise, gather occupational information, and plan for the future.

“This seems to indicate that mentoring and other support services play a much greater role in the academic experience for female students,” Bailey says. “It also shows a link between mentoring and success in one’s future career.”

The team is currently preparing to survey the student cohort during their fourth year in engineering. For students engaged in co-ops, the survey will be taken after their second round of work experience. The research will assess if significant differences in the impact on self-efficacy are seen between the genders and between those who co-op and those who don’t. Bailey presented initial findings at the 2012 Conference for Industry and Education Collaboration, sponsored by the American Society for Engineering Education.



A STEM Engagement Ecosystem: RIT computer engineering technology major Andrea Boarman, left, works with 8th grader Anna Christman as part of a camp sponsored by the Women in Technology program. RIT has created multiple outreach initiatives that seek to enhance enthusiasm for STEM fields among grade school and high school girls while also improving retention among current female college students.



WE@RIT: The oldest STEM outreach program on campus, WE@RIT provides a host of programs for 4th-12th grade girls, including summer camps that allow participants to develop their own designs such as the miniature doghouse shown above.

Creating a STEM Engagement “Ecosystem”

Faculty and administrators at RIT are utilizing the outcomes of the research in this area to define the key elements of a broader initiative that builds upon training programs and outreach to create an “ecosystem” designed to increase enthusiasm for, and participation in, STEM fields. Women in Engineering (WE@RIT), Women in Technology (WIT), Women in Computing (WIC), and Women in Science (WISe) all focus on offering educational and social activities, and volunteer and co-op opportunities for RIT students, as well as providing numerous on- and off-campus events and camps throughout the year for girls in grades K through 12.

Palmer notes that the engagement of college students in these outreach activities has a significant unanticipated benefit.

“In the College of Engineering we have seen a direct correlation between college student involvement with these outreach efforts and an increase in the retention of these women students,” he says.

The longest running of the programs is WE@RIT, which was founded in 2003 by a team of engineering faculty and staff led by Margaret Bailey. It currently reaches over 2,300 students and offers a number of on-campus events for area school children, including Girls Explore Adventures in Robotics (GEARs) and the Everyday Engineering Summer Camp. It also goes into local classrooms through the Traveling Engineering Activity Kit (TEAK) program, an NSF-funded initiative where RIT engineering students help introduce grade schoolers to science and engineering concepts.

It is also part of a broader College of Engineering initiative designed to make math and science more relatable for middle and high school students. The Relevant Engineering in Math and Science project, which is funded by the Toyota USA Foundation, includes the development of on-site and online activities and education modules, many of which will be woven into WE@RIT’s outreach efforts.

“WE@RIT is unique in the way that

we incorporate a multi-tiered teaching team of engineering students, faculty, and K-12 teachers to lead, inspire, and teach girls and young women in grades 4-12 about engineering, creativity, design, teamwork, and technology,” says Jodi Carville, the program’s director. “We do this by a variety of pre-engineering outreach programs specifically created for girls with grade level in mind.”

“It has been shown that STEM outreach efforts are most effective when they begin at an early age,” adds Palmer. “Girls as young as the fourth grade are already beginning to form lasting impressions of themselves and their future roles in society.”

WIT, created in 2005, WIC, in 2009, and WISe, in 2011, are also working to develop a stronger and more supportive social and educational environment for current and future students.

“Through the creation of a broad community of support we can help current students excel, assist alumni in giving back to the university, and provide an easy path for future female scientists



Teaching Computers through PicoCrickets:

Women in Computing program volunteer Noel Dasta, a fourth-year information technology major, introduces Fairport High freshmen to the PicoCricket. The device is a small, basic computer that can be programmed to play music or make dance-like movements and is used to illustrate basic computing concepts as part of WIC's high school outreach effort.

and engineers to follow,” adds Betsy Dell, the Paul A. Miller Professor in the College of Applied Science and Technology, who heads up WIT.

WIT runs a series of outreach programs that reach 4-12th grade girls, including the Girl Scout Technology program for middle school students and the Tech Squad Girls Technology Workshop for high school students. These programs are designed to provide a basic understanding of engineering concepts, while allowing participants to develop and test experiments in RIT’s packaging science, electrical, mechanical, and civil engineering technology laboratories.

WIC recruits current computing students to visit local elementary schools through the program Introduction to Computing Through PicoCrickets.

“A PicoCricket is a small, basic computer that can be programmed to play music or make dance-like movements,” says Sharon Mason, associate professor of networking security and systems administration and director of WIC. “We train computing students how to use them and then we go into elementary schools and

utilize the crickets to explain basic computing concepts. It is a great way to make computing fun and accessible.”

“It is our hope that the continued efforts of these outreach initiatives will ultimately enhance the overall number of women and minorities going into science and engineering fields and allow these disciplines to more directly mirror the national population as a whole,” adds Tubbs, a member of the steering committee for WISE.

Making a Difference

The combination of research and outreach has greatly enhanced RIT’s national recognition in the field. For example, WE@RIT won the 2008 Women in Engineering Program Award from the Women in Engineering Proactive Network. It has also begun to have an impact on female enrollment and retention in STEM disciplines as both numbers have increased over the last three years. However, all individuals involved in the effort agree that there is still much work to be done.

“We need to do more here on campus to make the environment even better for

women and minorities, and create a broader national focus on STEM education. We’ve seen that it does make a difference,” notes Palmer.

On a positive note, for women alumni, the change in environment, at RIT at least, is already noticeable.

“When I first came to RIT there was no organized effort to assist individual female students or build a broader community of women scientists and engineers at RIT,” notes Jacquie Mozrall, an industrial engineering graduate who is now professor of industrial and systems engineering and serves as the associate dean of RIT’s College of Engineering. “Today we have a significant infrastructure, in multiple colleges, to assist current students and encourage future generations of women to enter and succeed in the STEM fields.”

Women in STEM at RIT:

WE@RIT: www.rit.edu/kgcoe/women

WIC: www.women.rit.edu

WIT: www.rit.edu/cast/wit

WISE: www.rit.edu/cos/WISE

Historic Preservation Through Gaming



Elizabeth Goins

Close your eyes and imagine yourself exploring a centuries-old, gothic Parisian cathedral that was once the site of a battle during the French Revolution. Now open your eyes—and log onto your computer, where your video game guides you through the church's twists and turns and allows you to clearly identify architectural styles and symbols on grave markers.

Elizabeth Goins, assistant professor of fine arts, has won a grant from the National Park Service and the National Center for Preservation Training and Technology to develop an interactive game that will transport students to virtual worlds that will help teach key elements of historic preservation and conservation.

The project, which also includes professor Andrew Phelps and associate professor Chris Egert, both from RIT's interactive games and media department, seeks to determine how to create engaging interactive experiences that teach conservation and preservation through online methods. The team hopes to assess different avenues for both teaching conserva-

tion of cultural materials and developing new vehicles for presenting online historic worlds.

"Immersive worlds have the potential to create learning environments that can teach this multidisciplinary approach but game mechanics and pedagogical strategies have not yet been developed," says Goins. "For example, in the game, we have built a reconstruction of a real conservation project being conducted by the J. Paul Getty Trust on Nefertari's tomb. Through this we teach students about the materials and techniques of the ancient Egyptians and also the forensic methods developed in pigment identification."

Once the prototype has been completed, it will be tested and assessed on conservation classes at RIT and at the University of Delaware. Levels of engagement will be evaluated along with how well students learn the material.

Goins hopes the project will ultimately assist in increasing the use of gaming technology in



Oblitus Artium: RIT assistant professor Elizabeth Goins and her team created a virtual island called Oblitus Artium, Latin for "forgotten arts," and is meant to model ancient Venice. It is part of an interactive video game designed to promote deeper understanding of historical events.

teaching the concepts of conservation and preservation while also providing a more immersive experience for students.

Improving Postsecondary Education



Scott Franklin



Thomas Kim



Dina Newman



Kate Wright

Discipline-based education research combines the methodologies of cognitive science and education research, an expertise in teaching and learning, and a deep knowledge of disciplinary content to enhance postsecondary curriculum development and delivery. RIT's Science and Mathematics Education Research Collaborative (SMERC) is leading the way with new research on how students create and use different representations—graphs, pictures, and/or equations—in a variety of topics in physics, chemistry, and mathematics.

"There are numerous opportunities to combine previous work in educational modeling and community learning with expertise in specific scientific fields to improve the overall assessment of how STEM students learn," notes Scott Franklin, professor of physics and a member of the SMERC team.

A key focus of SMERC, which also includes

RIT professors Dina Newman, Tom Kim, Bob Teese, and Kate Wright, is the utilization of education research tools to study different facets of STEM teaching. This includes a project by Newman and Wright to assess methods for improving the teaching of meiosis in introductory biology classes.

"Meiosis, the main avenue for cell reproduction, is a central component in biology, biochemistry, and genetics, and understanding this process is extremely important for students in these fields," Wright says.

"Undergraduate biology majors are exposed to the process of meiosis numerous times during their presecondary and postsecondary education, yet understanding of key concepts does not improve substantially with repeated exposure," Newman adds.

Wright and Newman observed multiple introductory biology classes and conducted interviews of teachers and students to assess how the meiosis concept was presented and how students retained it. This included having students diagram the process based on information provided in a standard textbook as well as the use of word models to analyze the phrases and terminology used to describe how meiosis works.

The team found that community learning



Physics Professor Scott Franklin, center, is a member of the Science and Mathematics Research Collaborative, which uses discipline-based education research and student mentoring to improve science and math education at the postsecondary level.

environments with dynamic lesson plans that included use of new media and interactive components were much more effective in transferring the information than traditional classroom/textbook settings. They are now using the data to develop a pilot interactive lesson plan that they hope to incorporate in biology classes at RIT and other universities.

"This study shows the benefits that discipline-based education research can have in improving STEM learning both for students and for teachers," Franklin adds.



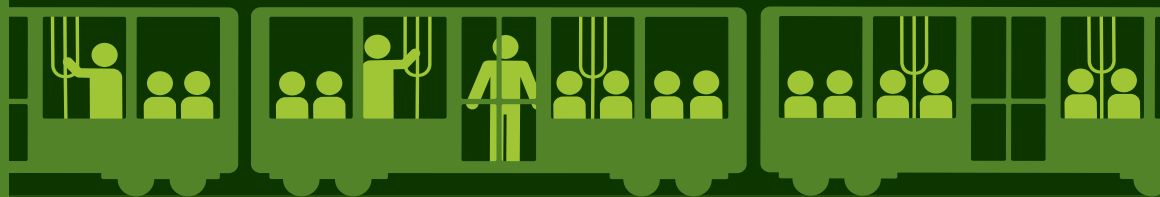
PLANET

PROFIT

PEOPLE

Enhancing People, the Planet, and Profit:

The New York State Pollution Prevention Institute at RIT is committed to meeting the three goals of the triple bottom line for sustainable development through the creation of new technologies and business practices that can reduce our environmental footprint, improve economic development, and create more sustainable communities throughout New York state.



Pollution Prevention

by William Dube

Pollution inhibits efforts to improve environmental quality while also imposing significant business costs that constrain economic growth. The New York State Pollution Prevention Institute (NYSP2I) advances research, development, and outreach that focuses on meeting the three principles of sustainability—people, planet, and profit—while also improving environmental quality and enhancing the productivity and competitiveness of New York state businesses.

Creating a Clearinghouse for P2 Technology

“Pollution prevention, commonly known as P2, focuses on the creation of processes and designs that prevent pollution at its source, as opposed to dealing with waste after it has been created,” notes Anahita Williamson, the director of NYSP2I. “It also seeks to lower the overall cost associated with industrial processes and future product development.”

NYSP2I was founded in 2008 and builds on over a decade of applied research conducted at what is now the Golisano Institute for Sustainability (GIS) in remanufacturing, process optimization, sustainable design, and life cycle assessment.

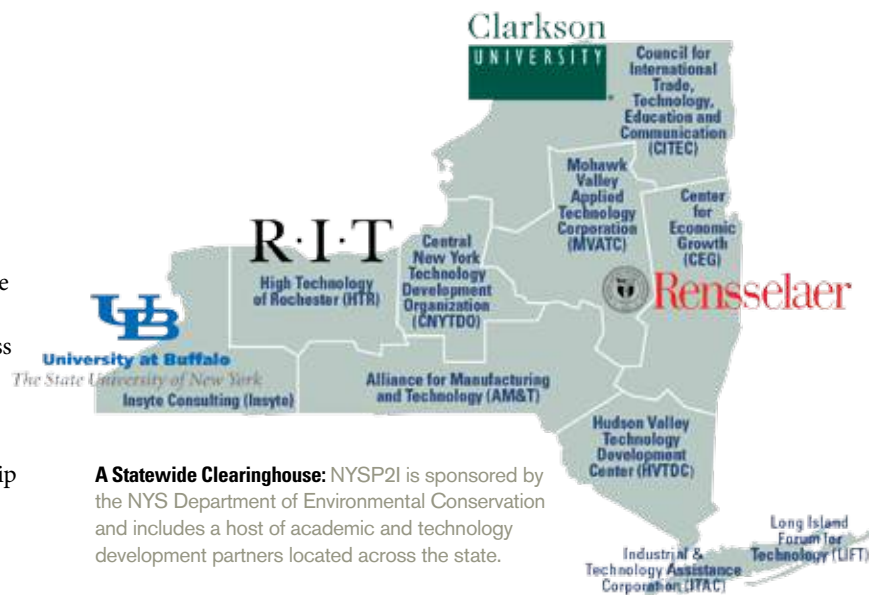
Funded by the New York State Department of Environmental Conservation (DEC) through the state’s Environmental Protection Fund, the institute is a partnership between RIT, Clarkson University, Rensselaer Polytechnic Institute, University at Buffalo, and the 10 New York State Regional Technology Development Centers. It works with its partners, various state business clusters, and individual manufacturers to develop new technical processes that can be used on individual projects and disseminated to the broader community to advance overall P2 goals statewide.

“We hope to serve as a benchmark for the ‘best and the brightest’ in P2 processes, while also being a model for other states and nations,” adds Williamson.

Research Applications with Impact

The institute works closely with its partner institutions to conduct research and technical assistance that have a real-world impact for New York state workers, communities, the environment, and the economy.

Over the last two years NYSP2I has worked with over 50 companies throughout the state, conducting environmental assessments of manufacturing operations to identify product and process improvement opportunities. These efforts have resulted in the reduction of nearly 2 million pounds of hazardous waste and materials and over 13 million gallons of water, and have saved over 1.5 million kilowatt-hours of energy.



A Statewide Clearinghouse: NYSP2I is sponsored by the NYS Department of Environmental Conservation and includes a host of academic and technology development partners located across the state.

In addition, the potential savings to businesses in New York state could reach \$12 million over the next 5 years.

These efforts also enhance the institute’s outreach, training, and education programs, allowing NYSP2I to provide the latest information and technical knowledge to New York state industries and the general public.

In part, due to NYSP2I’s success, Williamson was honored with the 2012 Environmental Quality Award presented by the U.S. Environmental Protection Agency.

“I congratulate Anahita Williamson and NYSP2I for their dedication to securing a cleaner New York,” says U.S. Senator Kirsten Gillibrand, who nominated Williamson for the award.

Enhancing Lead-Free Manufacturing

While encompassing a wide variety of focus areas, NYSP2I’s research seeks to develop scalable, cost-effective solutions that reduce waste, hazardous material use, and overall energy consumption in a wide variety of industries. This includes the



Research, Training, and Education: The NYSP2I team, led by Anahita Williamson (front), seeks to advance the incorporation of pollution prevention practices through basic and applied research, direct company assistance, professional training, and broader education initiatives aimed at the general public.

advancement of lead-free manufacturing technologies, the design of greener batteries, the reduction of toxic chemicals use in dry cleaning, and the development of more sustainable processes for the food and agriculture sector.

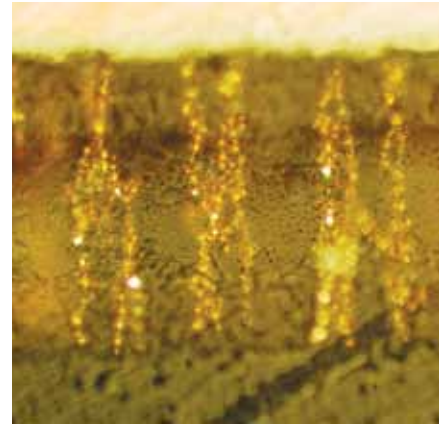
Current soldering processes used in printed circuit board assembly can contain significant amounts of lead, which can be toxic in large quantities. In addition, cleanup costs associated with the process greatly increase overall costs to manufacturers. Hence, lead-free soldering has become an important part of the transformation in the assembly of electronics. However, there are several issues associated with the widespread commercialization of the process, including high-temperature processing and high-energy consumption.

NYSP2I recently partnered with RIT’s Center for Electronics Manufacturing and Assembly (CEMA) to investigate the use of a unique anisotropic, or directionally enhanced, conductive adhesive for lead-free electronics assembly that could ultimately improve product quality and reduce the environmental footprint of the manufacturing process.

“Anisotropic adhesive, due to its low-temperature processing, has significant environmental and performance advantages but is still in the early stages of development and usage in commercial printed circuit board level manufacturing processes,” says S. Manian Ramkumar, professor of manufacturing and mechanical engineering technology and director of CEMA. “This project allows for additional testing of the unique ACA material to improve overall performance and enhance additional commercialization and use.”

The team, which also included RIT professors Changfeng Ge and K.S.V. Santhanam, investigated material property enhancements by using special additives to improve humidity-aging behavior and enhance long-term performance. They then conducted quality and wear assessments comparing the new adhesive blend to regular formulations.

Initial findings indicate that the new blend was more moisture resistant than previous formulations. This addresses one of the main issues in commercializing anisotropic conductive adhesives. The team is currently conducting additional



Improving Lead-Free Manufacturing: Pictured above is a cross section analysis of anisotropic conductive adhesive, which is a potential lead-free alternative for use in semiconductor electronics manufacturing. Through a partnership with NYSP2I, RIT professor S. Manian Ramkumar is conducting a series of experiments designed to test the durability and quality of the substance versus traditional adhesive methods.

research on the magnetic properties of the new adhesive formulation, another major factor in circuit board performance.

Developing Greener Batteries

NYSP2I also partnered with GIS faculty Gabrielle Gaustad and Callie Babbitt to develop more environmentally benign battery recycling processes.

The proliferation of portable consumer electronics such as computers, cellphones, and e-book readers, combined with expected expanded production of hybrid and all-electric vehicles, has placed significant new demands upon manufacturers for low-cost, energy-efficient, and environmentally friendly battery recycling processes. Currently, only 20 to 40 percent of consumer batteries are recycled.

“The current mismatch between the relatively short lifetime of lithium-ion-based vehicle batteries and the longer use of the hybrid and all-electric cars themselves creates significant challenges related to reuse and waste management,” notes Gaustad.

The three-year project, which has also received funding from the New York State Energy Research and Development



Producing Greener Batteries: A team of RIT researchers, including Gabrielle Gaustad, Chelsea Bailey, and Callie Babbitt, is working with NYSP2I on a project funded by the National Science Foundation to develop better design parameters to increase the overall sustainability and recyclability of lithium-ion batteries.



Converting to Wet Cleaning: Vicki and Raymond Rooplal, third and fourth from left, own Express Cleaners II in Queens, N.Y. They cosponsored a wet cleaning demonstration with NYSP2I's Kate Winnebeck, left, which sought to show other cleaners how to successfully implement wet cleaning operations.

Authority and the National Science Foundation, seeks to develop a comprehensive recycling and remanufacturing plan for lithium-ion technologies while also developing better design parameters to increase the overall sustainability and recyclability of the devices.

It will also work with battery manufacturers and the New York Battery and Energy Storage Technology Consortium to implement better reuse procedures into current business operations.

“Through this project we hope to better quantify the life-cycle impacts of end-of-life routes for lithium-ion technologies, while also helping to develop enhanced business strategies, which will create greater incentives for reuse,” adds Babbitt.

The team, which also includes chemical engineering professor Brian Landi of the Nanopower Research Lab and GIS research faculty Michael Thurston, presented its initial results at the 2011 NY-BEST Technology Conference, sponsored by the New York Battery and Energy Storage Technology Consortium.

Reducing Toxin Use in Garment Cleaning
On top of supporting individual research

projects, the institute sponsors a number of statewide initiatives including major programs with the garment cleaning and food sectors.

NYSP2I has received support from DEC and the U.S. Environmental Protection Agency for the New York State Professional Wet Cleaning Program. The effort seeks to minimize chemical use in garment cleaning and reduce the health and environmental impacts of the industry.

The program includes a survey of garment cleaning businesses in New York state and a series of wet cleaning demonstration sessions. In addition, it provides direct technical assistance to businesses in converting dry cleaning operations to more environmentally friendly professional wet cleaning processes. The reduction in chemical use will also reduce cleanup and regulatory costs to businesses and increase competitiveness within the sector.

“The garment cleaning process traditionally uses a number of environmentally sensitive chemicals, most notably perchloroethylene, or perc,” says Kate Winnebeck, Wet Cleaning Program Manager for NYSP2I.

According to the New York State

A Statewide Impact



Joseph Martens

“DEC furthers its commitment to environmental sustainability and economic vitality of New York state by supporting NYSP2I.

Businesses tap into a unique resource to reduce hazardous waste and overall costs.”—Joseph Martens, Commissioner of the NYS Department of Environmental Conservation



Nabil Nasr

“Through the development of clean technologies, NYSP2I is making New York greener and more economically competitive. Its efforts are an excellent complement to RIT’s

overall focus on sustainability.”—Nabil Nasr, Director, Golisano Institute for Sustainability at RIT



Paul MacEnroe

“NYSP2I is a key partner in promoting the economy and the environment. Through its efforts the institute has assisted businesses in implementing greener and

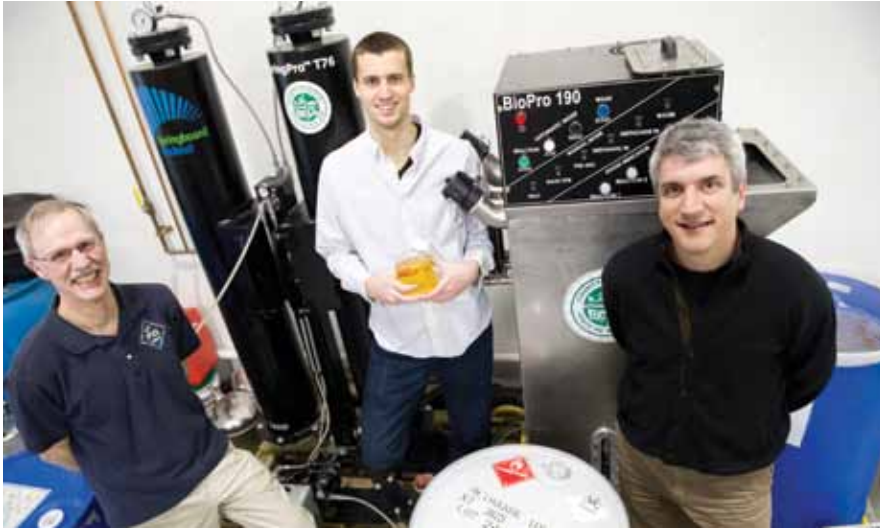
more efficient technologies.”—Paul MacEnroe, director of the Mohawk Valley Applied Technology Corp.



Yong Choi

“NYSP2I helped us to convert to wet cleaning. Since switching to the process, clothes come out cleaner and the costs and regulatory burdens

are reduced.”—Yong Choi, owner, All Fabric Cleaners, Suffolk County, NY



Improving Biodiesel Production: NYSP2I engineer David Fister, sustainability Ph.D. student Matt Rankin, and GIS research professor Thomas Trabold are working to improve the conversion process used to transform waste cooking oil into biodiesel fuel. The project is part of NYSP2I's Waste to Energy Initiative, which seeks to improve the quality and energy efficiency of biodiesel produced from food and agricultural waste.

Environmental Facilities Corporation and NYSP2I data, there are slightly less than 2,000 garment cleaners in the state, 80 percent of which use perc. These cleaners use more than 125,000 gallons of the chemical annually, resulting in the emission of over 90 metric tons into the atmosphere each year.

“Professional wet cleaning uses water as the cleaning solvent, creating a greener process with no reduction in cleaning quality. It also uses less water and energy than conventional dry cleaning,” Winnebeck continues.

In 2010, Winnebeck's team surveyed New York dry cleaners to identify the distribution of alternative solvents and the industry's attitude toward them. She is currently conducting a pilot conversion program, assisting two dry cleaners in converting to wet cleaning. NYSP2I is working with the converted cleaners, along with existing wet cleaners across New York state, to host demonstrations of their wet cleaning systems for other interested cleaners.

Promoting the Green Food Sector

NYSP2I also works with numerous federal and state agencies and local businesses to promote job creation and

enhanced environmental quality in the New York state food sector. This includes membership in the Western New York Food and Agriculture Industry program and the Finger Lakes Food Processing Cluster Initiative as well as work on a number of individual research projects.

“The food and agricultural industry has been a traditional strength in Western New York and we are focused on assisting them in implementing economic and environmentally friendly technologies that can help increase competitiveness,” Williamson says.

The Food and Agriculture Industry program, sponsored by the federal government's Economy, Energy & Environment (E3) initiative, is a pilot effort that seeks to enhance the competitiveness, energy efficiency, and overall sustainability of the western New York food and agriculture sector. Through the program, NYSP2I is developing a series of technical assistance and training initiatives, designed to improve sustainability and productivity in the sector.

In addition, NYSP2I plays a central role in the Food Processing Cluster Initiative, a jobs accelerator program at RIT, which focuses on assisting regional food processing companies in improving

competitiveness, creating jobs, and developing the local workforce. Through the program, the institute works with cluster firms to implement technical improvements and sustainable manufacturing process technologies that reduce operating costs and minimize environmental impacts. The initiative is funded by the U.S. Department of Commerce, the Department of Labor, and the Small Business Administration.

NYSP2I is also working, through its Waste to Energy Initiative, to identify potential opportunities for bio-based fuel production, to both reduce waste generated by the food sector and create an additional revenue stream for businesses. Advances made through the program are then woven into the institute's technical assistance efforts. This includes research designed to improve the conversion of food processing waste into methane-rich bio-gas and a partnership with Monroe County, N.Y., to assist in the creation of a centralized biodiesel production facility using waste oil and grease from public facilities.

Combining Research, Technical Support, and Education

Through all of these activities, NYSP2I seeks to meet its broad mission to educate industry, government leaders, and the general public on the importance of all aspects of pollution prevention in an effort to create more enlightened producers and consumers.

“For many years it was thought that environmental quality and economic productivity were mutually exclusive goals, but with advances in sustainable design and green engineering there are now viable methods to accomplish both together,” notes Williamson. “Through our efforts we hope to create a greater understanding of these opportunities and assist multiple industries and companies in taking advantage of them to become greener and more competitive.”

On the Web

To learn more about NYSP2I visit www.nysp2i.rit.edu.

Preserving Freshwater Ecosystems



Todd Pagano



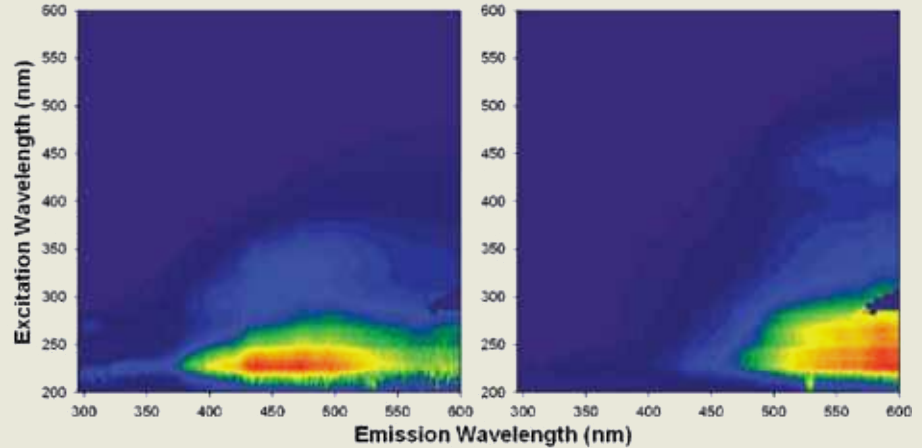
Christy Tyler

Dissolved Organic Carbon (DOC) in natural water systems has been changing in certain regions for the past three decades, which may be attributed to several factors, including global climate change and land use change. The substance, a product of the natural breakdown of plants and animals, is made up of many different chemical substances, some of which may contain

phenolic compounds, which can produce potentially harmful chemicals when combined with chlorine at drinking water treatment facilities.

Using a novel multidimensional fluorescent spectroscopy technique, Todd Pagano, associate professor and director of the laboratory science technology program at NTID, and Christy Tyler, assistant professor in the School of Life Sciences, are analyzing DOC dynamics in natural watersheds within the Finger Lakes region to identify sources and composition of DOC.

The research involves using chemometric techniques in the analysis of many water samples to assess the characteristics of the DOC and its phenolic content. In addition, they are studying the use of aquatic plants to serve



Parallel factor analysis (PARAFAC) is applied to multidimensional fluorescence measurements to determine the phenolic content of dissolved organic carbon.

as a bioremediation tool to remove phenolic DOC compounds from the water prior to treatment. This will reduce the potential formation of harmful disinfection by-products at drinking water facilities.

“This work allows us to make observations of a potential consequence of climate change from a different perspective—by looking, at a molecular level, at how the characteristics of DOC varies across regions and over time,” says Pagano.

“We hope to both advance our understanding

of dissolved organic matter’s role in fresh water systems and develop potential biological solutions to the problem,” adds Tyler.

The research team also includes Morgan Bida, a master’s student in environmental science, and Ryan Spector and James Macisco, students in the laboratory science technology program at NTID. The group presented initial findings at the 2011 Finger Lakes Research Conference, sponsored by the Finger Lakes Institute, and at the 2011 National Meeting of the American Chemical Society.

Predictive Failure Analysis



Nenad Nenadic

Equipment breakdowns are a major concern for vehicle fleet managers, particularly when dealing with military aircraft where mechanical failures can cause serious security concerns and even loss of life.

Nenad Nenadic, research associate professor at RIT’s Golisano Institute for Sustainability (GIS), is part of a team that is developing specialized predictive tools to better assess equipment failures in military aircraft. This includes a study with the Army Research Laboratory to assess and predict failure in gears used in Army helicopters.

“Large metal gearing is a major component in standard helicopter transmissions and there have been examples of fatigue and cracking of gear teeth that have led to equipment failure,” Nenadic says. “Of four dominant gear failure modes (breakage, pitting, scoring, and wear), breakage is the most dangerous, because the user perceives its occurrence as an abrupt failure with no prior warning.”

Nenadic’s research is focused on developing

the first statistically significant data set for comparing performance of existing vibration-based condition indicators with respect to their ability to detect cracks and assess the damage.

The GIS team utilized precision gears designed by NASA’s Glenn Research Center and manufactured locally by Gleason Corp. The project included the development of two test fixtures to analyze how and why gears fail.

The first fixture employs a fatigue tester and a unique approach for efficient initiation of realistic cracks. The second, based on a dynamometer, measures crack propagation and collects vibration data. The vibration data is accompanied with ground truth data of actual cracks obtained using crack-propagation sensors. The results will assist the team in developing a predictive failure model that can be used to improve gear maintenance and design.

The team presented its initial results at the 2011 Conference on Structural Dynamics, sponsored by the Society for Experimental Mechanics. They are also expanding the data analysis through the development of novel condition indicators with support from the Office of Naval Research.



Gear Analysis: Nenad Nenadic (right) and his team (left to right, Allen Luccitti, Arthur Dee, and Paul Ardis) are involved in vibration-based gear health monitoring. Gear breakage can be very devastating to a military vehicle, resulting in loss of life or a very expensive repair.

“The empirical data we are developing will serve the gear research community for better gear crack detection, assessment, and prediction of remaining useful life,” Nenadic adds.



A Creative Past and Present:

RIT's School for American Crafts is the oldest craft school in the nation and has a long history of artistic innovation. Today, SAC faculty and students are using this heritage as well as the latest technologies to develop new methods and means of artistic expression.

Blazing a Trail of Artistic Innovation

by Kevin Fuller

The School for American Crafts (SAC) at RIT is the oldest craft school in America and has long been one of the leading creative and educational forces in the Arts and Crafts Movement. Current SAC faculty Juan Carlos Caballero-Perez, Andy Buck, Jane Shellenbarger, and Robin Cass exemplify the school's dual mission to honor the American craft tradition, while also developing new and innovative methods for creating and presenting art.

The Past and the Present

SAC was originally founded at Dartmouth College and moved to RIT in 1950. In its 62-year history at RIT, the school has produced a host of students who have gone on to major careers in the field, while also being home to some of the nation's most prominent craft artists. Year after year, SAC has sought to promote traditional craft techniques, while also paving the way for current and future innovation in the arts.

"It's always been very important that our programs maintain

that traditional craft method," says Don Arday, the current chair of SAC. "At the same time, we seek new ways to enhance the creative process."

This includes study and artistic creation in ceramics, glass making, furniture design, contemporary jewelry design, and metal sculpture based on the fusion of craft making and fine arts that developed at places such as Germany's Bauhaus School in the 1920s.



Expressing Heritage and History in Art: Metals professor Juan Carlos Caballero-Perez produces a wide range of sculpture in steel, silver, and gold, from fine jewelry to large public art pieces. His work reflects his own background and culture, including historical motifs and forms inspired by his native Mexico.



Mother's Brooch by Juan Carlos Caballero-Perez: Sculpted jewelry featuring 22- and 18-karat gold, diamonds, and a South Sea pearl. It won a 2011 NICHE award for best gold jewelry.

In addition, current SAC faculty members are using modern techniques in material analysis, computer animation, and prototyping to develop new methods and means for expressing and producing craft art. In addition, they explore diverse topics such as history, politics, and science to better present their artistic themes. The school strives to transfer this creativity to its students through unique coursework and programming that balances the past, present, and future.

“Through our educational offerings and the creative work of our faculty and students, we seek to find new methods and means for expressing creativity,” Arday adds.

Expressing Heritage Through Sculpture

For longtime metals professor Juan Carlos Caballero-Perez, being a successful artist is a fusing of the past and the future. Born in Mexico City, Mexico, Caballero-Perez came to the United States in 1986. He

expresses that background in his art and in his course work.

“I like a lot of historical motifs,” says Caballero-Perez. “My own cultural heritage truly reflects in a lot of my work.”

That creative expression includes public art pieces for the National Technical Institute for the Deaf at RIT, the Pieters Family Life Center in Henrietta, and ArtWalk in downtown Rochester. In addition, he has created numerous acclaimed jewelry pieces, including “Mother’s Brooch,” which won a 2011 *NICHE Magazine* Award for best gold jewelry.

Caballero-Perez’s approach involves practical, hands-on research to get used to how a particular material works—be it steel, silver, gold, or some other medium. This includes the analysis of various material properties in order to better manipulate his chosen medium and ultimately translate his artistic expression into

finished sculpted pieces.

Caballero-Perez has also embraced technologies such as computer-aided design to enhance the prototyping and development of his pieces.

During the past two years, Caballero-Perez has attended numerous workshops and seminars on the use of computer technology in art creation, and has also incorporated these elements into his work as well as metals classes on campus.

“They are the ones who are going to really change the field,” says Caballero-Perez about his students. “They are the future of the industry.”

Despite all this innovation, Caballero-Perez still believes in the basics. He draws inspiration for his art from all manner of fields, from architecture to the natural world, and believes his work is rooted in the fundamentals of craft creation as much as the future.

“I live in the fundamentals,” he says with a smile. “I still like to draw.”



Storytelling Through Furniture Design: Andy Buck is interested in the many interpretations of artistic expression and its use in telling a story. He incorporates Polynesian, African, and American folk art and culture into a wide range of pieces, including tables, mirrors, and benches.

A Hand-Carved Narrative

In 1987, Andy Buck was a legislative aide to then-U.S. Rep. Leon Panetta, who is currently the Secretary of Defense for President Obama. Buck's days consisted of writing letters to constituents and researching legislation on behalf of the congressman.

That's when his life took a U-turn.

"After working on the Hill for a while," says Buck with a grin, "I decided to follow my heart and pursue a career designing furniture and making artwork." Having minored in furniture design at Virginia Commonwealth University, this was not as far-fetched as it might seem.

Buck is a storyteller with his hands. "I'm really fascinated by the narrative qualities associated with making objects by hand," he says.

Interested in the many interpretations of artistic expression, his work often

includes visual references to Polynesian, African, and American folk art. His wide range of furniture pieces has earned international acclaim and been exhibited at numerous galleries and museums, including the Fuller Craft Museum; the Museum of Fine Arts, Boston; and the Museum of Arts and Design in New York City.

At age 5, Buck's family moved to Switzerland where his father, a specialist in tropical medicine, began work with the World Health Organization. His father traveled the world, bringing back artifacts and many stories, stories of culture and of people.

"My father would come home with shields, masks—all sorts of interesting objects," he says. These artifacts from his childhood became original sources of inspiration many years later



Foyer Table by Andy Buck: The cherry and poplar piece was created for the 30th anniversary of the Pritam and Eames Gallery, a leading exponent of studio furniture.

as an artist. Buck explains his digging goes deeper than his past. Searching for new ways of working is at the heart of his research. The use of new technology is also an integral part of his work. Hand-carved parts are sometimes combined with laser-cut parts, laser-engraved text, and other computer-generated elements.

Research, innovation, and data collecting can be for the purpose of deconstruction, too, Buck explains. "I try to break down archetypes," he says. "I try to come up with ideas that are not so easily pegged."

It's that constant drive for innovation in his own work that he parallels in the classroom.

"In order to be an effective teacher, I must challenge myself with concept, material, and process, just as I try to challenge my students."



***Equilibrium* by Jane Shellenbarger:**

The soda-fired, black clay platter was inspired by the culture and history of Islam. It was featured as part of the group exhibition "Islamic Influence," presented by Florida's Crossroads Gallery.

Ceramics as Social Expression: Ceramicist Jane Shellenbarger incorporates historical references and social commentary into her functional pottery pieces. The goal is to create useful forms, while also expanding understanding of different cultures and societies.

Creative Expression in Ceramics

Jane Shellenbarger, professor of ceramics at SAC, focuses on pottery the idiom, incorporating historical references and social issues with domestic objects. Her work has been exhibited widely and is part of the permanent collection of the Renwick Gallery of the Smithsonian Institution's National Museum of American Art.

"While function continues to be an essential concern, I am most intrigued with the ability of pots to transcend themselves as objects and convey

information," says Shellenbarger.

Conveying information requires an intense regimen of constantly collecting data and research for both technical prowess and content. Shellenbarger focuses her research on utilitarian objects, while interjecting other aesthetic elements into the work. "There are so many ways you can think about your work fitting into society," she says.

Her art often becomes a document of history, while also bearing reference to painting, vessels, and even social content. "I like to explore both culture

and history through the pieces I create," she says.

Before coming to RIT, Shellenbarger was involved in a four-week artist residency at the International Ceramic Studio in Kecskemét, Hungary. She worked with master mold makers and absorbed the creative process of the European porcelain factory tradition which she then incorporated into her own work.

"Travel and cultural exchange is such an important aspect of what an artist does," Shellenbarger explains.

Her teaching is also an extension of her research.

"I try to get students to understand the value of research while building technical skill and immersing themselves in the information-gathering process," Shellenbarger adds. "I encourage students to build layers of information into their work."

She emphasizes to her students that the exchange of ideas is all part of growth as an artist. Whether it's conceptual growth or historical knowledge, it's all part of the craft.

"I look backward and forward at the same time," she says.



Combining Science and Art: Glass artist Robin Cass incorporates scientific forms and materials in her work, including fossils and molecular models, to illustrate how humans observe and understand the natural world.



Flagellated Galactolipid by Robin Cass: The blown and painted glass piece is part of Cass' Curious Growths series, tangled clusters of fleshy formations that evoke botanical or zoological specimens.

The Legacy of Frans Wildenhain

Ceramic artist Frans Wildenhain taught for 20 years at the School for American Crafts, earned a Guggenheim Fellowship, and produced a broad range of ceramic art.

His influence on the American craft movement is being celebrated through a major retrospective created by RIT professor Bruce Austin.

"Wildenhain was enormously significant in the development of modern ceramics, as an artist, an educator, and a partner in Shop One, one of the very first commercial craft businesses in the nation," notes Austin.

A public exhibit of approximately 150 examples of Wildenhain's mid-century modernist pottery and related artifacts will be held simultaneously at RIT's Bevier Gallery and Dyer Arts Center from Aug. 20 through Oct. 2, 2012.

Austin is also producing an exhibition catalogue comprised of color photographs of the objects on exhibit, Wildenhain's biography and scholarly essays on the mid-century studio ceramics movement, and a case study of marketing of crafts through Shop One. "The project illustrates and explains Wildenhain's role in transforming craft from a modestly scaled artistic effort into a mainstream interest," Austin adds.

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A hand-thrown stoneware vase with multicolored glaze, circa 1965, by RIT's School for American Craftsman founding faculty member Frans Wildenhain.

Two Worlds Come Together

Some artists draw from the most unlikely sources for inspiration. Glass professor Robin Cass often reaches from the science world for her art.

Cass comes from a science-oriented background, with doctors, pharmacists, and biologists throughout her family tree.

"Growing up in this environment instilled me with a fascination of the language and artifacts of the sciences," she says. "But I became more interested in their poetic rather than practical aspects."

For Cass, her love of glass as a material meshes perfectly with her interest in the sciences. "Glass has such a rich history as a material used in scientific research, from alchemical vessels to lenses, glass has had a profound effect on how we observe and understand the natural world."

Cass has explored all ends of the earth for interesting sources for her sculpture. During a sabbatical last year, Cass was a resident artist at the Osaka University of Art in Japan. While in Japan, she visited places like the Meguro Parasitological Museum and Tskiji fish market in Tokyo.

"I find the obscure scientific museums and urban food markets in other coun-

tries are often especially inspiring places."

Cass' unique creative style has earned her international acclaim and her work has been exhibited by a host of major arts centers, including the Museum of American Glass, the Tacoma Museum of Glass, and the Tittot Museum in Taipei, Taiwan.

Cass' creative process also relates to how she teaches. She constantly encourages her students to delve deeply into all subjects that pique their curiosity.

"I ask students to follow those tangents—read, collect images and materials. It's so important for artists to try and understand their interests on a deep level; it helps you make more nuanced and powerful work."

There has to be substance, she adds, and that's the basis of research in the arts. "Art about art is kind of a dead end."

A Center for Innovation in the Arts

The artistic and educational efforts of Caballero-Perez, Buck, Shellenbarger, and Cass exemplify the School for American Crafts' efforts to promote creative innovation and enhance education in the arts. It also highlights the school's mission to honor its past, while promoting new ways to create art in the 21st century. ■

Documenting the Culture of Mexico



Denis Defibaugh

The Festival of the Virgin of Candelaria is one of Mexico's largest religious and cultural events and has come to exemplify the celebration of life and family that are central themes in Mexican society.

Denis Defibaugh, professor of photography at RIT, has sought to document the celebration as a method for examining Mexican culture and its strong focus on religion, history, and heritage.

"The Candelaria Festival nominally celebrates the conversion of Mexico's indigenous population to Christianity in the early 16th century by the Virgin of Candelaria, a well-known prophet and Catholic saint," Defibaugh says. "However, today it has become a means for celebrating all manner of Mexican life, including the fusion of Spanish, African, and indigenous cultures as well as Mexican art, music, and fashion."

The festival begins in late January and runs through early February. Centered in the city of Tlacotalpan, in the state of Veracruz, it includes a religious procession to honor the Virgin, a

large music festival, bullfights, and a ceremonial running of the bulls.

"One part religious observance, one part cultural showcase, and one part massive party, the fest illustrates the fusing of different religions, civilizations, and cultures that make up modern Mexico," Defibaugh adds. "It is informative to see this fusion in practice through Candelaria, particularly when compared to the often-segregated cultural expressions seen in American society."

Defibaugh has traveled to the annual celebration on multiple occasions to photograph the festival and its participants. He has showcased the work in a number of exhibitions and is currently developing a book based on his photos with noted Mexican historian Ward Albro. Defibaugh has also made the photographs available to Candelaria organizers and participants as well as Mexican scholars.

The effort was funded by the Texas Council



Documenting the Culture of Mexico: Participants in the Candelaria festival prepare a doll for the Procession of the Virgin of Candelaria, one of the key religious observances of the fest.

for the Humanities and Innova Corp., and builds on Defibaugh's previous photo project designed to document Mexico's Day of the Dead festival.

"Through this project and my previous work in Mexico, I have tried to showcase the beauty and power of Mexican life and provide a deeper understanding of the breadth and depth of Mexican culture," Defibaugh says.

The Art and Engineering of Pop-Up Books



William Finewood

Pop-up books, which fuse three-dimensional shapes and movable components with traditional illustrations and narratives, are one of the most unique artistic forms. Combining elements of origami, paper engineering, and dimensional sculpture, the average pop-up book takes a year to design and every copy must be hand-assembled.

"The process is very much like a miniature engineering project," says Bill Finewood, associate professor in the School of Art. "Pop-ups come to life through movement and don't lock the viewer into a single moment frozen in time like a normal book does. It is an extremely unique experience for the reader, which is one of the forces that drive artists who work in the form."

Finewood has sought to promote pop-up artists and enhance education in the form, as well as develop his own artistic creations. This includes the development of *Pop-Up Books: An Interactive Exhibition*, which debuted at RIT's Bevier Gallery. The exhibit featured work from leading artists/authors in the field, including Chuck Fischer (*The White House*), David A. Carter (*Bugs in Space*) and Kyle Olmon (*Castle*). It also included a step-by-step display illustrating



A boy and his grandfather observe an eagle bringing food to its chicks in a scene from *A Cavu Day*, a pop-up book being created by RIT professor William Finewood.

the many components required to transform 2-dimensional designs into a finished 3-D book.

"Pop-up artists rarely get the respect they deserve for the work they create," Finewood notes. "Through this exhibit we were able to promote the work of a number of artist/authors and highlight both the technical innovation and artistry inherent in their work."

Finewood has also created a course at RIT

focused on pop-up art, as well as community presentations highlighting pop-up design. He is currently working on his own pop-up book, tentatively titled *A Cavu Day*, which he hopes to release in 2013.

"Through all of these efforts I hope to promote the continued development and enjoyment of pop-up books as a unique creative outlet," Finewood adds.

Research Awards and Honors

by William Dube

RIT values the research contributions of its faculty and staff across all colleges and honors these accomplishments through the Principal Investigator Reception each February, as well as through recognition events hosted by colleges and centers throughout the year. Below are members of the RIT community who have received significant university, national, and international awards in the last year.

Distinguished Public Service Awards

The Four Presidents Distinguished Public Service Award was created by the late Alfred L. Davis, vice president emeritus, on the occasion of the 65th year of his association with RIT to commemorate the dedication of the last four RIT presidents in their service to the Rochester community. The award is presented annually to a member of the RIT faculty or staff whose public service and commitment mirrors that of the four presidents who worked with Davis. The Bruce R. James '64 Distinguished Public Service Award is presented annually to an RIT student or alumnus and commemorates the public service of Bruce James, former U.S. Public Printer and chairman emeritus of the RIT Board of Trustees.

Four Presidents Award



Steven Morse, assistant vice president of institute audit, compliance and advisement, was awarded the 2012 Four Presidents Award.

Morse, a 1986 accounting graduate from RIT's E. Philip Saunders College of Business, joined RIT in 2004. He has a long history of support for community and campus organizations, including service as president of the board of directors of the Rochester School for the Deaf and membership on the NTID

Foundation board. He is also a member of the Saunders College of Business Accounting Advisory Board and volunteers for the Susan B. Anthony House and the New York Transportation Museum.

Bruce James Award



David Kelbe, the Bruce R. James Distinguished Service Award winner, earned his bachelor's degree in imaging science from RIT in 2010.

Kelbe travels internationally to volunteer in various capacities. Most notably, he is affiliated with the St. Matthew's Orphanage Center in Myanmar, where he has served as a teacher, mentor and financial supporter for more than two years. Locally, he volunteers at Dimitri House, a men's emergency homeless shelter. He also serves as a teaching assistant and mentor on the RIT campus.

National and International Recognition



Andy Buck, a professor in the School for American Crafts, has been named a 2012 Summer Artist in Residence at the Tacoma Museum

of Glass. Buck is a noted furniture designer whose works have been exhib-

ited at numerous museums and galleries, including the Fuller Craft Museum and the Museum of Arts and Design. Through the residency he will work with a team of artists to weave glass designs into his furniture pieces.



Evan Coyne, a third-year student in international hospitality and service management, was awarded a 2011 Statler Foundation Scholarship

of Excellence for outstanding achievement in academics, student research, and service to the hospitality industry. The Foundation, founded in 1928, is dedicated to advancing innovation and professional development in the hotel industry.



Kenny Fourspring, a Ph.D. student in imaging science, and **Christine Trombley**, a doctoral candidate in astrophysical sciences, have both been awarded 2011-2012 Graduate Student Fellowships by the National Aeronautics and Space Administration. The fellowship is dedicated to promoting development in NASA's key research areas and includes an internship at a related NASA research laboratory.





M. Ann Howard, senior associate dean of the College of Liberal Arts, has been named a 2012 Champion of Sustainability. The award, sponsored

by the American College Personnel Association, honors the individual or group that best models the triple bottom line of sustainability—healthy environments, social justice, and strong economies. Howard directs RIT’s University/Community Partnerships program, which promotes sustainable development in the city of Rochester.



Andres Kwasinski, assistant professor of computer engineering, has been named editor of *Transactions on Wireless Communications*,

a peer-reviewed journal published by the Institute of Electrical and Electronics Engineers.



Dina Newman, assistant professor of biological sciences, has been appointed a 2011 BEN Scholar by the BiosciEdNet Collaborative.

The honor recognizes scholars who make significant contributions to the field of discipline-based education research. Newman is an expert in curriculum development and research training in the biological sciences.



James Perkins, professor of medical illustration, was selected to participate in the international exhibit “Anatomy of an Image,” which celebrates the history and development of

medical and scientific illustration. The project was sponsored by the European Association of Medical and Scientific Illustration and was exhibited at the Zoological Museum of Strasbourg, France.



Erinn Ryen, a doctoral candidate in sustainability, has been named a 2012 STAR Fellow by the Environmental Protection Agency. The award, which

is part of the EPA’s Science to Achieve Results program, honors outstanding graduate research in applied environmental studies. Ryen previously won the Jacqueline Shields Award for outstanding graduate research in waste management sponsored by the Air and Waste Management Association.



Jonathan Schroeder, Kern Professor of Communication, has been named to the editorial board for the *Journal of Consumer Research*.

Published by the University of Chicago Press, it is one of the leading academic publications in consumer marketing and theory. Schroeder is an international expert in visual communication and advertising.



Donald Sims, associate professor of communication studies and services at NTID, received a 2011 Focus on People Award from the Oticon Founda-

tion. It honors students, adults, advocacy volunteers, and hearing care practitioners who have demonstrated that being deaf or hard of hearing does not limit a person’s ability to make a difference in his or her community.



Bruce Smith, head of the department of microsystems engineering, received the 2011 Research Mentor Award from SPIE, the International

Society for Optics and Photonics. The honor recognizes Smith’s efforts to promote student research and professional development in the fields of optics and microlithography. Smith previously received the SPIE Fellow Award for contributions to microsystems research.



Adam Walker, a master’s student in science, technology and policy, has been named a 2012 Entrepreneurship Fellow by the Kauffman Founda-

tion. Walker was selected based on his involvement with Kosovo Wind Gardens, a small business venture that is marketing wind turbines for use in rural areas of Kosovo. The Kauffman Foundation is the largest American foundation with a focus on entrepreneurship and innovation.



Jason Younker, associate professor of anthropology, and director of RIT’s Native American future stewards program, has been elected as president

of the Association of Indigenous Anthropologists. The national professional society is dedicated to promoting anthropological study of indigenous peoples and is part of the American Anthropological Association.

About This Section

This listing is a sample of awards and honors that have been received by RIT faculty and staff over the past year. For more information, please visit www.rit.edu/news.

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Rochester Institute of Technology is internationally recognized for academic leadership in computing, engineering, imaging technology, sustainability, and fine and applied arts, in addition to unparalleled support services for deaf and hard-of-hearing students.

For two decades, *U.S. News & World Report* has ranked RIT among the nation's leading comprehensive universities. RIT is featured in *The Princeton Review's* 2011 edition of *The Best 373 Colleges* as well as its *Guide to 286 Green Colleges*. *The Fiske Guide to Colleges 2011* lists RIT among more than 300 of the country's most interesting colleges and universities.

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To learn more about research opportunities on campus, contact us directly or through the RIT research website at www.rit.edu/research.

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