

2023 MATERIALS SCIENCE AND ENGINEERING



Pawel Koblinski

Professor and
Department Head,
Department of
Materials Science and

Welcome

Greetings to our MSE alumni and friends,

I am privileged to share the highlights of RPI materials community achievements, activities and stories we experienced within last academic year. As is our tradition, we use this annual sharing to reflect on the community focus of our materials endeavors at RPI. Thus, please enjoy a lot of stories involving our undergraduate and graduate students, staff, faculty, and alumni. We wish to also take you back to century-old stories of our RPI alumni who were pioneers of materials science and engineering at RPI and across the United States.

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Memorial

Welcome [cont.]

Let me first share with you that our beloved Professor David Duquette passed away in February. He joined RPI as an assistant professor in 1970 and served with distinction for over 50 years. His research produced many ground-breaking advancements in the fields of metallurgy and corrosion. He graduated more than fifty Ph.D. students and was a world-leading expert in corrosion and materials failure. I enjoyed immensely my informal conversations with Dave, particularly listening to numerous stories, such as when he stopped Amtrak Acela trains in the Northeast Corridor for a whole week (over the objection of some powerful people) due to unacceptable cracking in the train wheels. His work may well have saved many lives. To learn more about rich and fulfilling life of Prof. Duquette, please enjoy the story in this Newsletter.

We are immensely excited about our newest faculty hire. Professor Wei Bao joins our department as a new Assistant Professor this fall, following several years of faculty experience at the University of Nebraska. Even though he is early in his career, he is highly successful and recognized with many awards. Quite remarkably, he started his independent research career at Nebraska at the same time as Covid brought the nation to a halt. This did not deter Prof. Bao from achieving many great things, including experimental research in the laboratory. He delivered groundbreaking advances in quantum photon-photon and photon-electron interactions, which are critically important for quantum computing. His work has been reported in top-tier journals including *Nature Communications*, *Nature Materials* and *Nature Photonics* and has been supported by \$2.5M in ex-

ternal research funding. We look forward to his further growth and success at RPI.

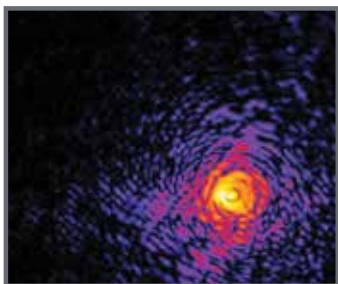
You will find in this 2023 Newsletter issue many interesting and compelling stories, including an extensive interview with undergraduate Connor Foreman describing his path towards RPI, the multifaceted experience at RPI and a look into the future. You will find yet another story about the trail-blazing excellence of Prof. Jian Shi and recent recognitions bestowed upon him by IEEE. We also proudly present the inspiring story of James A. Parson Jr. BS 1922, a pioneer Metallurgist and Educator. Among other activities, he led a world class laboratory developing corrosion-resistant stainless steel alloys, which at the time was fully staffed by Black employees.

As you are aware, RPI will soon celebrate a 200-year anniversary – we are the oldest technical school in the English-speaking world! We hope that many of you will visit us, particularly at celebratory peak in the Fall 2024 semester. We are currently planning a materials-centered event, where we hope to see as many of you as possible.

Please enjoy the stories we report to you and, as always, feel free to reach out and share any thoughts, ideas and your own successes with us. Perhaps our next news story will be about you!

Thank you,

Pawel Keblinski
Professor and Department Head
Materials Science and Engineering Department
Rensselaer Polytechnic Institute



Cover image: Cancer cell with normalized intensity (a. u.)

On the Cover: Professor Edwin Fohtung recently received an award funded by Gordon and Betty Moore Foundation Funds to lead a Team of scientist in a project “Beyond Diffraction Limited Imaging: Predicting Cancer and Immune cell phenotype”. The award will cover postdoctoral funding for three years along with other supplementary support for equipment and efforts. the ACB work is funded by the “Gordon and Betty Moore Foundation.

This project aims to investigate the mechanism of Plant-derived Extracellular vesicles (pEV) uptake and antitumor/anti-inflammatory effects in complex tissue microenvironments using a non-invasive, high-resolution lens-less photon-based imaging technique that bypasses the diffraction limit. This technique can image live cells in 3D without staining or labeling, making it applicable to various scientific areas.

COMMENCEMENT AWARDS 2023



Kyle Gallik

Istvan S Moritz Award (2017) was presented to Kyle Gallik. This is an annual award based on funds contributed by Meeli Leith, Rahmi Ozisik, and Moritz family; the award is made to a senior or co-terminal student in materials science and engineering who has demonstrated a keen interest in materials field and shows further growth in their future career.



Saloni Pendse

The Outstanding Teaching Assistant Award was presented to Saloni Pendse. This award is given annually to a graduate student in Materials Science & Engineering who has exemplified the world-class pedagogical quality at Rensselaer through outstanding performance as a teaching assistant.



Max Feuerman

The Matthew Albert Hunter Prize in Metallurgical Engineering (1951) was awarded to Max Feuerman. The 2023 annual award is based on the income from funds contributed by former students of Dr. Hunter. The prize is awarded annually to the senior in materials engineering who has demonstrated outstanding ability in academic work leading to a career in that field.



Sydney Neuman

Scott Mackay Award (1958) was awarded to Sydney Neuman. This is an annual award based on the income from funds contributed by former students of Professor Mackay, the award is made to a senior in materials engineering who has given time and effort to the service of others without seeking recognition or acclaim, and who has completed the academic program at Rensselaer creditably.



Casey Cafasso

The Doreen Ball-DiFazio Award (2017) was won by Casey Cafasso. This award is given to a female senior with outstanding academic achievements and service to the community.



Anna Capuano

The 2023 Graduate Studies Award was presented to Anna Capuano. This award is given to a graduating senior, who has exhibited outstanding academic performance and leadership abilities, and goes on to pursue graduate studies.

Commencement Award Party

Top: (l to r) Max Feuerman, Spencer Brockdorff, Kyle Gallik, Oleksky Golub.

Bottom: (l to r) Anna Capuano, Casey Cafasso, Sydney Neuman.



RPI23 GRAD



ADVANCED DEGREES AWARDED IN 2023

Congratulations and the best of luck!

Congratulations to our newly minted Ph.D.s and Masters in Materials Science & Engineering!

Our 2023 Ph.D.s: Dr. Andrew E. Ehlers, Dr. Bronson Hausmann, Dr. Zhenhan Huang, Dr. Atharv Jog, Dr. Gopal Kenath, Dr. Sushant Kumar, Dr. Haidong Liu, Dr. Saloni Pendse, Dr. Donovan Weiblen, and Dr. Lifu Zhang!

Earning a Master's Degree: Matthew Abraham (ME), Michael Bagdasarian (ME), Spencer Davis (ME), Yang Lou (ME), Elijah Schold (ME), Hasin Tamim (ME), Jeriah Bankson (MS), and Alexander Brofsky (MS)!

We are so proud of our newest Materials Science & Engineering Masters and Ph.D graduates! Someday you'll look back and think, wow, I graduated at the strangest time ever! Until then, we'll be here for you, cheering you on, looking forward to wherever life takes you next, and feeling so proud of you. Hard work, talent, drive and vision will always outlast tough times. That's how we know you're going to make the world what you want it to be.



MAY COMMENCEMENT DINNER

1

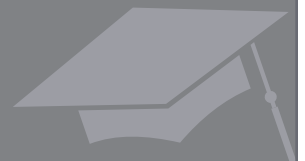
(l to r) Meeli Leith, Anna Capuano, Anna's Parents

2

Graduate Casey Cafasso, winner of the Ball-Difazio Award, with the Difazios, who attended the dinner.

3

Mr & Mrs Moritz present the Istvan s. Moritz Award



STUDENT AWARDS & HONORS



Anshuman Thakral places first in 3 competitions!

Graduate Student Mr. Thakral won Best Poster Award for on campus research at RPI. The posters were presented to RPI associates to show what research is ongoing on campus. This award had a \$100 prize for first place. The name of the winning poster was “Epitaxial Cubic Co(001)/MgO(001) Layers As Potential Interconnect Conductors”.

He also won Best Presentation (GRS): May 12th, 2023. This was part of the 8th Graduate Research Symposium, a competition held annually at RPI. The competition consisted of a 7-minute oral presentation followed by 5 minutes of questioning. Mr. Thakral placing first in this competition, which had a \$500 prize money for the winner. The topic of the talk was “Resistivity of Metastable Face-centered Cubic Cobalt”.

And in addition, Anshuman won first place 3 Minute Thesis Competition: May 12th, 2023. The Challenge

was to present your research in 3 minutes of allotted time. There were 2 rounds in this competition. The first round was held on May 8th, 2023, with 13 finalists taking part in the final round held on May 12th, 2023. This had a first-place prize of \$1500. The title of the winning talk was “Interconnects: Past, Present and Future.”



2023 Norman S. Stoloff Research Excellence Award

Ru Jia and Saurabh Pandey are the winners of the 2023 Norman S. Stoloff Research Excellence Award. The award which is given annually to two senior graduate students, recognizes the students for their outstanding research accomplishments, as evidenced by a submitted or published journal article in the past 12 months. Each received a cash prize and an award certificate following their presentation as part of the department seminar series.

Ru Jia won for “Composition gradient-enabled circular photogalvanic effect in inorganic halide perovskites.”

Saurabh Pandey won for “Real-time study of imaging electron current density on metal filament evolution in SiO₂ during in-situ TEM.”

about Norman S. Stoloff



Norman S. Stoloff

Norman S. Stoloff had a very long and distinguished career as a faculty member of the Materials Science & Engineering Dept at Rensselaer Polytechnic Institute (RPI). One measure of the long-lasting effect of a researcher's work is to see his/her results, figures and micrographs become part

and parcel of undergraduate textbooks. Norman's work on intermetallics and superalloys attained that status in the early 1980s. Norman's legacy at RPI is commemorated by an endowment fund set up in his name with the purpose of rewarding an outstanding graduating doctoral student in materials science.



Poyen Shen presenting at the 2023 NNN Symposium

Graduate student Poyen Shen makes presentation at the 2023 NNN Symposium at UAlbany on April 25th, 2023.

“Advances in the Semiconductor Industry”

The Cornell NanoScale Facility and the University at Albany SUNY hosted the second New York State Nanotechnology Network (NNN) Symposium geared toward connecting NYS undergraduate and graduate students with our NYS industry partners for the purpose of

learning about and discussing “Advances in the Semiconductor Industry.” The day included a morning session with student, government, and industry talks, and an afternoon Poster Session & Career Fair!

Eight students, including Poyen Shen presented talks and 43 students presented posters.



(l to r) Prof. Grace Xing (Cornell University), Jack Coyle, Emma Sponga, Tomas Palacios (MIT), Roman Caudillo (Intel/SRC)

Emma Sponga and Jack Coyle present at JUMP 2.0 SUPREME

MSE undergraduate students Emma Sponga and Jack Coyle designed and built a new ultra-high vacuum deposition system as research project in Prof. Gall’s research group. They presented their work at the Semiconductor Research Corporation JUMP 2.0 SUPREME center review at

Cornell University, August 1-3, 2023. Emma and Jack won the Best Lightning Presentation Award for their presentation and poster “Design and construction of a sputter deposition system to explore new interconnect materials and interfaces.”



Tanooj Shah, one of our graduate students, presented his abstract titled “First principles molten salt phase diagrams through thermodynamic integration” at the 2022 American Nuclear Society Winter Meeting November 13th -17th and at the Molten Salts PI Meeting at Argonne National Lab April 25th-26th 2023. He has also been invited to present the same work at the American Chemical Society Fall Meeting.

RPI Material Advantage is a professional society by and for students interested in materials science, engineering, and technology.

by Kaitlyn Castonguay

During the course of the spring 2023 semester, Material Advantage hosted numerous events and expanded our club welcoming many new members, including 3 new members on our elective board!

Our events included both social, academic, and philanthropic events. Some of our social events included a gingerbread house building contest, an Easter egg hunt around the MRC, a trivia pizza party, and we even hosted our 2nd annual ice cream social.

Academically, we maintained our hosting of monthly "Matchat" - hosting Materials Science and Engineering professors such as Dr. Rahmi Ozisik and Dr. John LaGraft, and welcoming in graduate student Daniel Syracuse. Additionally,

we have continued to host Engineering 1600 review sessions to prepare students taking Introduction to Material Science for exams.

Philanthropically, we hosted a raffle to support our fellow RPI students with proceeds going to SWENext, a SWE program, which empowers young women in STEM. We also created an RPI Material Advantage team through the American Red Cross. This way, students can show support and build comradery within the Material Science Department while also helping out with the blood shortage. The team so far has impacted 60 lives and counting!

In the fall semester, we look forward to hosting many new events and expanding our horizons to try new events!

2023 E-Board Positions:

President:
Kaitlyn Castonguay (2024)

Vice President:
Finley Donachie (2024)

Treasurer:
Connor Foreman (2024)

Secretary: Ethan Booth (2024)

Outreach Director:
Cristina Gandolfo (2026)

Professional Development
Chair: Jynene Alfay (2026)

Advocacy Director:
Elizabeth Flynn (2025)

Social Media/Public
Relations Director: Emma
Sponga (2024)

Materials Advantage students enjoying activities in the student lounge area.



STUDENT SPOTLIGHT

Connor Foreman



Why did I choose RPI for my studies?

While I was in high school, I knew I wanted to study engineering, or I was at least interested in it. However, I was not sure what kind of engineering was best for me so I wanted to go to a college that offered a wide variety of engineering degrees. Prior to touring, I spoke to a family member, who is an RPI alumni, about the rigorous academics and challenging course work, as well as the reputation that accompanies a degree from RPI. I knew the school work would be extremely challenging, but also very rewarding. When I toured RPI, I was very impressed by the campus, the resources available to the students, and the abundant student-run clubs and organizations to get involved with. It seemed to me that there was plenty of opportunity for students to be involved in campus life and to develop themselves both professionally and personally. I also appreciated how the campus was fairly walkable, with a majority of

the academic buildings being located around the '86 field.

What RPI organizations am I a part of?

I'm currently a member of the Material Advantage chapter at RPI where I have served as the treasurer for three semesters. I have also participated in Engineering Ambassadors for nearly three years, having joined during the spring 2021 semester. As an Engineering Ambassador, I have the privilege of inspiring grade school students to pursue a career or degree STEM via engaging and interactive presentations. I have always found helping others learn to be a very rewarding experience. In addition, giving presentations on multiple topics has helped me improve my communication skills tremendously. I have recently become an active member of the Fishing Club as of spring 20223 and have already enjoyed several outings with the club.

What aspects of Materials Science am I passionate about?

From my recent experiences working at Volvo Trucks and General Dynamics, I have become very passionate about failure analysis and joining methods for metallic materials. These two areas alone encompass a vast majority of the basic principles which govern the mechanical behavior, performance, and properties

of metallic materials. I was first introduced to failure analysis when working at Volvo Trucks. My department would often receive broken engine components and we were tasked with determining the most-likely cause of failure. I find this type of investigative work to be especially interesting since no two broken components ever look the same, yet they both could have failed by the same mechanisms. These investigations also require the use of a wide variety of lab equipment, ranging from simple optical microscopes to advanced SEM analysis techniques. For me, learning to use modern analysis equipment was an incredibly rewarding learning experience. On the other hand, the methods by which materials are joined requires a firm understanding in the basics of material thermodynamics, and presents a whole new level of challenges and variables that impact the resulting mechanical performance of the materials being joined. Prior to working at General Dynamics, I was completely oblivious to the complexity of welding. After working there this summer (summer 2023), I have a new-found interest in welding and other material joining methods. While it was fascinating to learn about the different welding techniques and reasoning behind the use of different materials, what

really sparked my passion for welding was how the resulting mechanical, and chemical, properties of your weld can change based on a wide variety of factors. Depending on the process used, voltage/amperage settings, and material type (of both the base material and filler material) all affect the resulting characteristics of the final product and the quality of the weld. In addition to the typical failure modes encountered during failure analysis, welding introduces a much broader range of possibilities for failure, which results in an investigative process unlike no other in materials science.

What career am I interested in?

From my past two internships, I have greatly enjoyed working with, and learning from, other engineers in addition to working in a lab-based environment where I'm constantly moving around. Transitioning from college to the working world, I want to find a career that reflects a similar flexibility. I have always been a very hands-on learner, and being able to observe and ask questions about a process or an investigation in real time allows me to conceptualize, understand, and appreciate what I'm working on. Ideally, I would want to work in a research and development group performing failure analysis, material development, and/or manufacturing.

"I want to be able to ensure people are as safe as possible. Materials Engineers are in the unique position to offer expert advice regarding the performance of specific materials in specific functions."

What research interests me?

Currently, the research that is the most interesting to me relates to the manufacturing and fabrication of materials. In recent years, additive manufacturing has come a long way and is quickly beginning to reveal its potential in the manufacturing of metallic parts and components. This process significantly reduces the amount of material that is wasted in comparison to conventional castings. Additionally, this technology can be used in a broad range of industries from aviation to the medical industry. For expensive materials, this is an especially useful process due to the small amount of material that is wasted in addition to the ability to produce complex geometries. I am also interested in research relating to complex failure modes in materials, specifically hydrogen assisted cracking. At my internship with General Dynamics I had the opportunity to get a basic understanding of this phenomenon, but I have not had the opportunity to delve further into the dominating theories surrounding hydrogen assisted cracking. During my internship my team was mainly concerned with minimizing the main factors that contribute to

this method of cracking. After this brief introduction, I am extremely interested in investigating this issue further.

What is my favorite part about being at RPI?

My favorite part about being at RPI is the ability to meet so many industry professionals in such a short amount of time, usually in the form of my professors. Throughout my undergraduate education, I have had the opportunity to speak with and pick the minds of multiple materials science and engineering professionals. In addition, I have also had the chance to learn from engineers who worked for NASA, GE, and many other highly influential and successful organizations. The professors I've had were always more than willing to share their experiences with me and provide incredibly useful career and life advice. Additionally, I have also met so many great friends during my time at RPI, and I attribute much of my success in the classroom to our ability to collaborate and understand our coursework together.

What are my spare time hobbies?

In my spare time, I enjoy exploring the hiking trails in

the regions surrounding Troy and the RPI campus, as well as fishing the many bodies of water that can be found in these areas. During my summer ARCH semester at RPI, I discovered Grafton Lake State Park, which has some great hiking trails and fishing opportunities. In fact, my first trip with the fishing club was to Grafton Lake and I managed to catch the only fish that day (For those wondering it was a Largemouth Bass)! More recently I have been finding a lot of satisfaction in working on my car, this summer I redesigned the sound system and replaced the brakes. Going forward I'm not sure what I'll do next with my current car, but one day I hope to be able to restore an old car from around the 1970's.

How do I want to change the world?

Depending on where I go after college my answer to this question will change, but generally I want to be able to ensure people are as safe as possible. Materials Engineers are in the unique position to offer expert advice regarding the performance of specific materials in specific functions. Should I work on a team developing some type of vehicle (boat, car, plane, etc.), a structure, or any

other product, I want to be able to confidently say that, from a materials standpoint, the users will be completely safe regardless of the circumstances. Wherever I work, I want to be able to serve as a trusted subject matter expert for a wide variety of materials and processes. From my time as a Boy Scout, I discovered that I have a strong passion to help and improve the lives of others, and as a materials engineer I feel as though I have a direct impact on the lives of countless people. materials make up everything you use, and the importance of using the correct material for a specific application should never be understated.

What was my favorite memory of my time at RPI?

RPI hockey games are always the highlight of the year for me. I have many great memories of attending countless games with my friends and family. It's always exciting to get involved with the fan-fare and scream along with the crowd supporting the RPI Engineers! Nothing beats the up-beat sounds of the pep-band and the enthusiastic flag bearer that runs around the field house when the Engineers score!

EVENTS

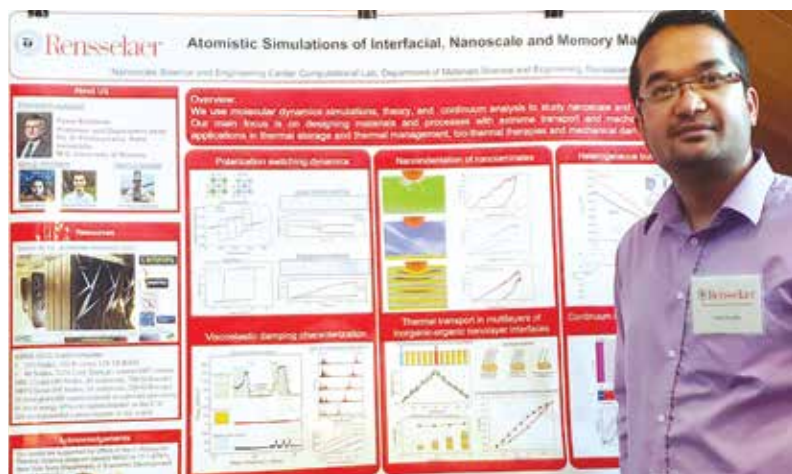


Materials Science & Engineering students enjoyed our annual Lunar New Year's Party to welcome the Year of the Rabbit!



"It was my first ever poster presentation in my academic career. It was really nice experience to display the overview and highlights of research activity taking place in our group to new students joining RPI."

—Rajan Khadka



MSE's Rajan Khadka shared this photo of our Poster Presentation for Accepted Student's Day March 25, 2022.

Rajan's Advisor: Dr. Pawel Keblinski.

Research: Atomistic simulations of interfacial, nanoscale and ferroelectric memory materials.



Wei Bao

Materials Science & Engineering welcomed with utmost enthusiasm the Appointment of Dr. Wei Bao as a new Assistant Professor in the Department of Materials Science and Engineering.

By Katie Malatino

Dr. Bao graduated from Peking University (Physics + Chemistry minor), continuing with MS in Mechanical Engineering at UCLA and concluding with PhD in MSE at UCB. Some highlights of his PhD research include first authored Science and Nature Communication articles and recognition of his excellence in the area of nano-optics and 2D materials by 3 major student awards: The MRS Graduate Student Gold Award in 2015, the Nanometer Scale Science and Technology Division Student Award from the AVS, and an R&D 100 Award (R&D Magazine 2013).

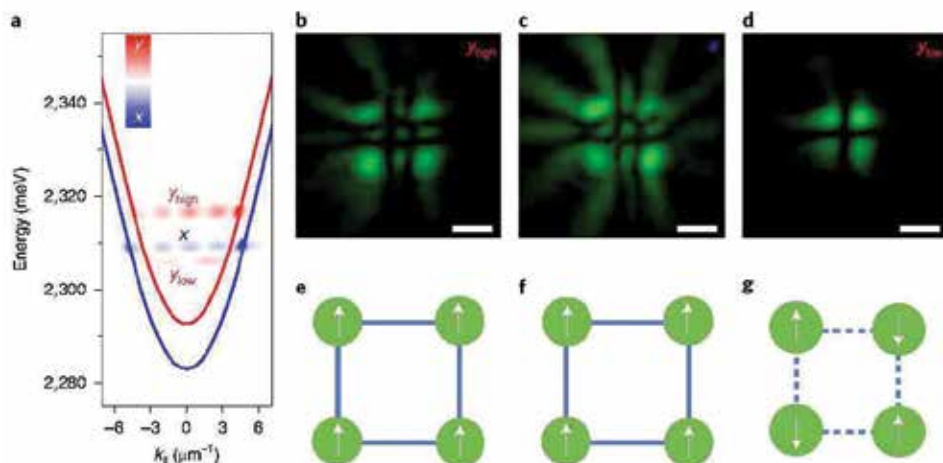
Dr. Bao continued to demonstrate his research excellence

as Postdoctoral Researcher at UCB in the group of Xiang Zhang, Ernest S. Kuh Endowed Chair. In 2019 Dr. Bao started his independent research career as an Assistant Professor at U. Nebraska Lincoln. Quite extraordinary, despite COVID emergency, Dr. Bao career flourished to new heights with groundbreaking advances in the area of quantum photon-photon and photon electron interaction, very significantly involving demonstration of quantum effects relevant to quantum information and quantum computing at room temperature, thus with significant broad practical/engineering promise, as opposite approaches based of quantum

effects manifesting themselves only at cryogenic conditions. Highlights of his research at Nebraska include 3 Nature publications (*Nat. Commun.*, *Nat. Mater.* and *Nat. Photon.*) and ~ 2.5 millions of research funds he raised including single PI NSF Career Award, and two ONR awards.

At RPI, Bao is poised to continue and further build a career at RPI in the broad area of quantum materials and for quantum information and quantum computing applications. His specific current activities are (i) halide perovskite and 2D materials-based quantum simulator (NSF CAREER Award), cavity vacuum

fluctuation dressed matter (AROPending), metasurfaces for quantum photonic simulation (NSF EPSCoR), and quantum-inspired photonic crystal lasers (ONR regular and DURIP grant supported). All these activities, along with numerous new possibilities arising from his interactions with experimental and theoretical efforts at RPI are intimately connected areas of growth and future associated with quantum materials, photonic based quantum communication with application of quantum computing as well as to microchip communication technologies.



Left: a, By using deposited pillar arrays (Supplementary Fig. 2) as spacers and bonders in between two DBR mirrors (nine pairs of SiO₂ and Ta₂O₅ alternating layers), a nanocavity of a designed height for halide perovskite crystals is formed so that the detuning between exciton and photon can be controlled. b, The scanning electron microscopy cross-sectional image of a fabricated nanocavity. Scale bar, 1 μm. c, The after-growth cavities are opened. The crystal thickness controllability and uniformity is revealed by AFM imaging (inset) and a cross-section profile (the white dashed line in the inset); the thickness of as-synthesized crystal from the nanocavity is ~329 nm (±0.4 nm), which matches the designed height of the nanocavity (~330 nm). Scale bar, 10 μm. d, This nanometre-scale-precision thickness can be well controlled in a wide range as measured by AFM. The <1.6% of thickness variance across each chip (2 cm size) is caused by pillar film deposition uniformity

FACULTY AWARDS



Jian Shi

Rensselaer Polytechnic Institute's Jian Shi, Ph.D., associate professor of materials science and engineering, as well as physics, applied physics, and astronomy, has won the prestigious 2023 IEEE Ferroelectrics Young Investigator Award.

The award recognizes “the important contributions of young scientists/engineers in reference to their contributions to fundamental research, integration, application, or education.” Recognizing only one or two exceptional scientists in the relevant field each year, this highly competitive award serves as a prestigious accolade for independent scholars under or at the age of 40.

Shi was honored “for his exciting out-of-box work on ferroelectrics and new way exploration of old materials.” His contributions include enriching the basic knowledge of spin-electric polarization relation and phonon-electric polarization relation in polar quantum materials. The research leading to Shi's award was published in *Nature* 607, 480, 2022, *Nature Photonics* 16, 529, 2022, *Nature Nanotechnology* 16, 894, 2021, *Science Advances*, 6, eaay4213, 2020, and more. His research has been supported mainly by the United States Department of Defense, Air Force Office of Scientific Research, Army Research Office, Office of Naval Research, National Science Foundation (NSF), the NSF

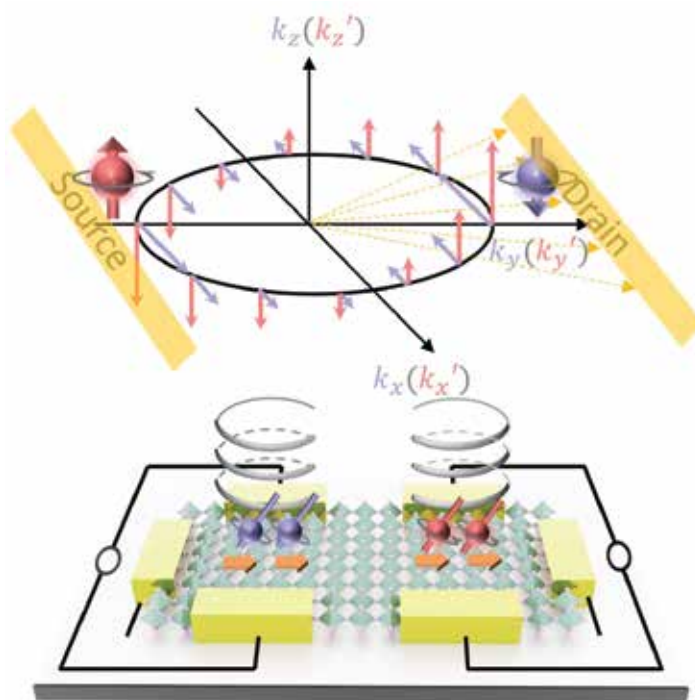
MIP Platform for the Accelerated Realization, Analysis, and Discovery of Interface Materials, and the State of New York.

Shi's research interests are polar, spintronic, chiral, and Berry parameters-tunable materials for spin/quantum computing and energy transformation. “My group works on obtaining basic understanding on the roles of photon, carrier momentum, symmetry, and phonon of novel materials on the transport behaviors, spin dynamics and optoelectronic properties, and developing experimental approaches and solutions on searching for new electronic materials and device structures toward energy-efficient, high-performance spin and quantum computing,” Shi said.

Shi earned his doctoral degree in materials science from the University of Wisconsin at Madison in 2012. After his postdoc research at Harvard University,

Shi joined Rensselaer Polytechnic Institute in 2014. He is associate editor of the *Journal of Applied Physics*. Previously, he won the James M. Tien '66 Early Career Award, the ASM International Geisler Award, the Rensselaer Polytechnic Institute School of Engineering Research Excellence Award, and the Air Force Office of Scientific Research (AFOSR) Young Investigator Research Program (YIP) Award.

Below: Jian Shi group explores new Rashba-Dresselhaus spintronic materials for controlling electron spin coherently and taming quantum decoherence.



FACULTY PROMOTIONS



Robert Hull

Dr. Robert Hull Appointed Vice President for Research

Please join me in welcoming Dr. Hull as Vice President for Research. • President Martin A. Schmidt '81, Ph.D.

I am pleased to announce that I have appointed Dr. Robert Hull as Vice President for Research, effective February 1, 2023.

Dr. Hull has served as Acting Vice President for Research since March 2020. Dr.

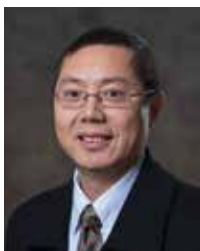
Hull joined Rensselaer in January 2008 as Professor, Department Head for Materials Science and Engineering, and the Henry Burlage Jr. Professor of Engineering. He continues to serve as director of the Rensselaer Center for Materials, Devices, and Integrated Systems (cMDIS), where he has led basic and applied research initiatives across a broad spectrum of fields in engineering, and the physical and chemical sciences.

Prior to his tenure at Rensselaer, Dr. Hull spent a decade at Bell Laboratories in the Physics Research Division and a decade at the University of Virginia, where he was director of a National Science Foundation Materials Research Science and Engineering Center, and director of the UVA Institute for Nanoscale and Quantum Science. Dr. Hull is known internationally for his research into fundamental mechanisms of semiconductor materials and devices, the self-assembly of nanostructures, and the kinetics of materials processes at the nanoscale.

His current research focuses on developing new nanoscale assembly, fabrication, and characterization techniques using focused ion and electron beams applied to a broad range of materials systems. He has published approximately 300 journal and conference papers; edited many books and proceedings; given approximately 300 keynotes and invited talks or seminars at national and international conferences, workshops, universities, and government and industrial laboratories.

Dr. Hull has been a member of many academic, editorial, and advisory boards. He is a fellow of the American Physical Society and the Materials Research Society (MRS). He has served as MRS president and chair of the University Materials Council. He has participated in multiple national committees and studies, including serving as the chair of a Committee of Visitors for the Division of Materials Research at the National Science Foundation and as a member of a committee reviewing the National Nanotechnology Initiative, organized by the National Academies.

Dr. Hull received his bachelor's degree in physics from Oxford University in 1980 and his doctoral degree in materials science from Oxford in 1983.



Jie Lian

Dr. Jie Lian has been named the William Weightman Walker Professor at Rensselaer Polytechnic Institute. An endowed chaired professorship is among the highest honors bestowed on a Rensselaer faculty member.

Dr. Lian is a Professor in the Department(s) of Materials Science and Engineering, and Mechanical, Aerospace, and Nuclear Engineering. His research uses state-of-the-art materials synthesis and characterization experiments to obtain fundamental understanding of advanced materials to tackle important problems in energy. He has authored over 300 papers in journals including *Science*, *Nature Nanotechnology*, *Nature Materials*, *Nature Communications*, *Physical Review Letters*, *Journal of American Chemical Society*, *Journal of Nuclear*

Materials, *Nuclear Instrument Methods*, *Physical Research B*, *Journal of Materials Research*, among others. Jie has also contributed three book chapters and holds 2 patents. He has an H-index of 65 with over 19,000 citations!

Dr. Lian has received many awards for his pioneering work, including best paper awards from the *Journal of the American Ceramic Society* in 2018 and two at the 2010 Microscopy and Microanalysis Annual Meeting, the NSF Faculty Early Career Development Award in 2012, the James Tien '66 Early Career Award at Rensselaer in 2016, and twice winning RPI School of Engineering Research Excellence Awards.

Dr. Lian received a B.S. degree in Materials Science from Yanshan University in 1994. He earned three master's degrees in Materials Science (Tsinghua University, 1998), in Nuclear Engineering (University of Michigan, 2000), and in Electrical Engineering, also from Michigan in 2002. He received his Ph.D. at the University of Michigan in 2003 with a concentration in Nuclear Engineering and Radiological Sciences. Dr. Lian joined the tenure-track faculty at Rensselaer as an Assistant Professor in 2008. In 2013, he received tenure and was promoted to Associate Professor, and in 2017 was promoted to Professor.

STAFF SPOTLIGHTS



Chao Yang

Chao Yang, Laboratory Manager for Electron Microscopy, is from China, and has lived in New Hampshire, Vermont, Indiana and Arizona before moving to Troy to work at RPI in 2023. Chao got his PhD in Material Science & Engineering at Dartmouth College, was a postdoc at Purdue University, and then MSE Supplies in AZ as a business development specialist. He is responsible for overseeing the operation and management of the electron microscopy laboratory, and applying his advanced knowledge and expertise in the advances of electron microscopy. He

also provides laboratory support for undergraduate and graduate coursework.

Chao arrived in Troy to start his work in January 2023 – a big change in the weather from Arizona! He is settling in well, and as a member of the LGBT community, he appreciates the accepting atmosphere at RPI. When he is not working in the lab, he is “a big nerd” and enjoys gaming (card, board and online), TV and movies. He is also a fan of hiking and swimming, and loves the natural beauty of this area of the country.



Nick Matthias

Nick Matthias, Administrative Specialist and Graduate Program Administrator, joined RPI in June 2023. He is responsible maintaining records of graduate students, prelim exam set-up, candidacy and defense exams, as well as graduate student finances. He coordinates teaching assistants each semester, prepares and processes Rensselaer Experience for Undergraduate (REU) student paperwork, and coordinates the monthly graduate Seminar series, and is a smiling face for anyone visiting MRC 142.

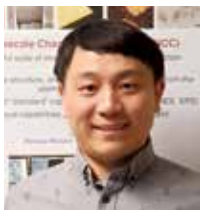
Nick grew up in Springfield, Massachusetts, and has lived in Schenectady NY, Providence, RI, and now is back in the Capital district. He went to Holyoke Community College for Liberal Arts, with a degree in Cultural Anthropology/ Archaeology. He was

previously employed in retail management for many years, as well as managing new store openings.

Nick says “What I enjoy about working here is the fact I get to meet and interact with these BRILLIANT students and professors. All of which have been very welcoming and great to talk with!

“I would say the “good experience” I have had here at RPI is more of an ongoing one. Daily it is learning something new, and being around the people who are here. The vibe is really remarkable.”

When he is not in MRC 142, he enjoys day trips and food and painting things from ceramics to furniture. to old houses. He loves all kinds of music: Middle Eastern, Celtic, 60s & 70s Rock, and singing the most!



Yechuan “Leo” Chen

Yechuan “Leo” Chen, Surface Science Laboratory Manager, is from Jingdezhen China, and joined RPI in early 2023.

Leo manages the Surface Science Laboratory including the operation of the X-Ray Diffraction, Auger Electron Spectroscopy and X-Ray Photoelectron Spectroscopy (XPS) instruments in the Materials Research Center. He is responsible for the day to day operation of the Surface Science Laboratory as well as strategic direction of future upgrades and additions to facilities, equipment and new techniques in equipment use. He also trains students, researchers

and faculty on safe and proper use of equipment and maintaining and repairing equipment.

He has lived in Chengdu China, New Mexico, and Irvine and Palo Alto California, and got his PhD from the University of New Mexico. After that, he went on to be a postdoc at the university of Irvine, CA and at the National Laboratory in Stanford, California.

He enjoys the work-life balance that RPI provides, as well as the dining opportunities in the area. In his spare time, he is interested in Asian and European History, simulation electronic games, and loves going on road trips.

ALUMNI SPOTLIGHTS



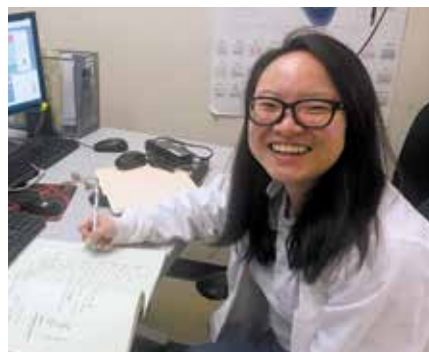
Patrick Strohbeen

I graduated from RPI in the winter of 2015 and pursued my Ph.D. in Materials Science and Engineering at University of Wisconsin Madison, advised by Jason Kawasaki. Under Jason I completed my thesis work titled “Applications and Mechanisms of Remote Epitaxy” in which I studied the behavior of surface adatoms in various configurations when deposited on graphene-terminated semiconducting substrates. I am now a Postdoctoral research associate at New York University under Javad Shabani in the Center for Quantum Information Physics, in the Physics department. Currently my research involves thin film growth of novel disordered superconductors and their integration with group IV semiconductor heterostructures.

I still remember working on the first lab report for “Mechanical Properties of Materials” over the course of two days straight, where our group of 8 ended up running around campus frantically searching for a literature value of the fracture toughness of 1018 steel. Within every text

we could find the value was left blank in the tables and thus we quickly started referring to it as “obviously unbreakable”, as clearly it was so tough we hadn’t developed a technique strong enough to measure it yet. While we did end up successfully finding the fracture toughness literature value for this alloy, the countless hours of scouring inevitably became a pseudo-motivational joke about how one should remember to be more like 1018 steel in times of stress – unbreakable. This remains as one of my favorite memories from my time at RPI and my academic adventure. Well, either that or Prof. Ullal introducing molecular beam epitaxy (MBE) in the final year Synthesis and Processing course as “...[too expensive to go into great detail about]...” which led me to becoming an MBE grower for my career.

If you would like to read more about the work I conducted in graduate school or keep up with my current work at NYU, you can find my publications on Google Scholar.



Haoxue (Lily) Yan

I grew up in Xi’an China and came to the US as an exchange student in high school, and then continued to pursue a B.S. in Materials Science and Engineering from RPI. I have recently obtained my Sc.D. from MIT with a thesis on understanding the hydrogen segregation near boundaries and its implications for defect behaviors. I am currently at Stanford University since last fall as a postdoctoral researcher to investigate how dislocations climb and grow in semiconductor lasers. After Stanford, I am hoping to find a lecturer position, through which I can share my appreciation of science with students and illustrate that science is full of fun and challenges. Throughout my Ph.D., I had enjoyed spending six hours a week playing volleyball. I enjoyed competing in tournaments with my friends and keeping the ball up at all costs. In my free time, I also like to bake and eat desserts, fiddle with my plants, and annoy my cat.



February 2015

(l to r) Tim Krentz, Steven Lee, Emily Aaldenberg, Liping Huang, Matthew Marshall, Jonah Duch, Lily Yan, Sarah Straub, Trevor Keller, Grace Zhou, Wei Peng, Cansu Ergene, Brent Engler, Aditya Prasad, Shanon Barra, Ainsley Pinkowitz

DEPARTMENT HISTORY

2023 NIHF Inductee James A. Parsons Jr.: Metallurgist and Educator Forging an Innovative Path



Each year since 1973, the National Inventors Hall of Fame® (NIHF) has honored visionary U.S. patent holders who have shaped the way we live. As we celebrate our 50th year, we look forward to inducting our 2023 class of Hall of Famers. We invite you to read on to learn about 2023 Inductee James A. Parsons Jr., one of the visionary innovators we are honored to celebrate this Black History Month.



Parsons was born in 1900 in Dayton, Ohio. As a young man, he received an appointment to the U.S. Naval Academy but he decided not to take it. His father, his high school guidance counselor and his father's employer, Duriron Co. founder Pierce Schenck, feared he would be unsafe at the academy, so they urged him to instead enroll at Rensselaer Polytechnic Institute (RPI). Schenck paid for his studies at RPI, and in turn, Parsons spent his summers working for Duriron, a manufacturer of pumps and valves for chemical processes located in Dayton. This proved to be an important step toward an innovative future for Parsons.

After graduating from RPI in 1922 with a bachelor's degree in electrical engineering, Parsons soon took on full-time work at Duriron. As an analytical chemist, he worked on

alloy compositions and metal processing methods. He then began to focus on the research and development of corrosion-resistant, stainless steel alloys and high-silicon alloys.

In 1929, Parsons earned the first of eight patents he would obtain in the development and application of noncorrosive metals, and he then began to work on developing the steel formulation that would come to be known as Durimet 20. Classified as a high-alloy austenitic stainless steel containing nickel and chromium with lesser percentages of molybdenum, copper, silicon, manganese, carbon and other elements, the composition of Durimet 20 is balanced to provide greater sulfuric acid resistance over conventional stainless steels. It also maintains equal or superior resistance to many other important corrosives.

Duriron produced the first commercial castings from Durimet 20 in 1935, and it became the basis for a family of stainless steel alloys used throughout all industries that involve the handling of corrosives.

Parsons received an honorary doctorate from Wilberforce University in 1941, and as he continued his work with Duriron, he became the company's chief metallurgist and laboratory manager. Upon his retirement in 1953, the Dayton Daily News reported on the team Parsons had managed, noting that Duriron was likely the only company of its kind that had a laboratory which was fully staffed by Black employees.

Building a Legacy

Following Parsons' retirement from Duriron, he chose to bring his expertise to the field of education. The metallurgy

The 1922 Rensselaer yearbook describes Parsons as hard working, ambitious, and popular with his peers.



program he organized at Tennessee A&I State University (now Tennessee State University), is believed to be the first of its kind at any historically Black college or university. During his tenure from 1953-66, he served as professor, department head and dean of the engineering school.

He also served as an adjunct professor at the Ohio State University and as an instructor at an occupational training center in Dayton.

Parsons' honors include a Citation for Meritorious Contributions to the Science of Metals in the Field of Corrosion Resisting Alloys from the American Society of Metals in 1953 and the Distinguished Community Service Award from the Dayton Urban League in 1983. He also was added to the Dayton Walk of Fame in 2007.

HISTORY MRC



Materials Research Center

The Materials Research Center (MRC) was constructed under the first facilities grant awarded by NASA on September 25, 1962. According to James E. Webb, NASA administrator, the purpose of the grant program was "to house interdisciplinary activities in space related sciences and technology to universities which are making substantial contributions to the national space program." The NASA grant provided for a \$1.5 million, 56,000 sq. ft. research facility. An additional grant from the National Science Foundation for \$500,000 provided funding for an Engineering Science Research wing. The project, totaling 96,000 square feet, was completed by architects Skidmore, Owings and Merrill at a cost of \$2.6 million. Twenty-five laboratories, designed in part by faculty, provided facilities for

powder metallurgy, polymer, ceramics, ultrasonics, cryogenics, corrosion and other materials research. The material research program was directed by the Interdisciplinary Material Research Committee consisting of eight faculty members, the director of the research division and an administrative director.

The MRC was formally dedicated April 23, 1966 as part of the "Man and Materials" symposium. Detler W. Bronk, chair of the RPI Board of Trustees and president of Rockefeller University; Arthur Schlesinger, author and historian; J. Erik Jonsson, trustee and CEO of Texas Instruments; and Chester F. Carlson, inventor of xerography and consultant to Xerox Corp. were among the guest speakers at the event.

IN MEMORIUM



DR. ZIJIE YAN

With great sadness we share with you that our alumnus, Zijie Yan, PhD 2011, was killed August 28, 2023 at the University of North Carolina Chapel Hill campus, where he served at an associate professor in the Department of Physical Sciences.

He is remembered fondly by many of us that met him in the classroom, lab, or in the hallway of MRC. Among other things, he distinguished himself with publishing 17 journal articles in the course of his PhD study and continued his successful career as a postdoc at the University of Chicago, and later as a faculty at the Clarkson University and recently at the University of North Carolina Chapel Hill.

"Zijie was a brilliant student, easy-going and always with a big smile, and he had grown into a rising star in his field at UNC. It is such a tragedy for his family, and a huge loss for the materials research community," said Dr. Yunfeng Shi, professor of materials science and engineering at RPI. "It is so shocking that violence has taken someone I knew well. This happened on the first day of class, and I had actually just been telling my current class my experience of teaching at RPI for the first time in 2008, in which Zijie was one of the students. College campuses need to be safe, open, and welcoming for students to grow and ideas to emerge, with academic rigor to safeguard our collective future."

Dr. Doug Chrisey, Jung Chair of Materials Engineering and a Physics Professor at Tulane University, said of Yan: "He was a great cook and would cook for all his roommates wherever he lived. His microwaved lunches were the ones you wanted to steal. He was a very sweet man and I am devastated that his life ended needlessly from gun violence involving mental illness."

A quote from Yan: "Life has many other interesting things and you will have tons of time to explore. For traveling in the future, I don't remember if you ever went to China, but it is worth going. That said, the last time I went back was already 8 years ago. A long time".

Of blessed memory Yan Zijie, a wonderful father and human being.

DAVID DUQUETTE

Long time RPI Materials Science & Engineering professor David J. Duquette of Loudonville, NY passed away on Tuesday, February 21st, 2023.



In 1970 Prof Duquette joined the faculty of the Materials Science and Engineering Department at Rensselaer Polytechnic Institute (RPI) in Troy, NY where he found a career home for the next 53 years. During his time at the Institute, he served as Department Chair and was given the honor of a chaired professorship, the John Tod Horton Professor of Engineering. During his time at Rensselaer, Professor Duquette's activities and accomplishments as a teacher, scholar, and valued member of the Institute and professional communities set a very high standard. He was particularly proud of having been thesis advisor to more than 50 doctoral students.

Prof Duquette was born on November 4th, 1939, in Springfield, MA (Indian Orchard) to Joseph Duquette and Jeannette Bernier. He

graduated from Springfield Technical High School and was a proud graduate of the United States Coast Guard Academy – Class of '61 (Never Outdone). He achieved the rank of Lieutenant in the Coast Guard during four years serving on Ocean Station Vessels in the North Atlantic.

He obtained his PhD in Metallurgy and Materials Science from the Massachusetts Institute of Technology in Cambridge, MA. He spent two years as a Research Associate in the Advanced Materials Research and Development Laboratory at Pratt and Whitney Aircraft in Middletown, CT.

Dr. John Leman said "I remember well a meeting where Dave was presenting results of some microscopic examination he had made of sample from the plant, and he was so dumbfounded by the magnitude and extent of the corrosion he saw in his microscope that ordinary words failed him. Some of the process engineers had been hopeful that a simple replacement of the failed piping with stainless steel would solve the problem, but Dave insisted that no, that was not going to be a solution, because even the expensive stainless steel was

*And may there be no sadness of farewell,
When I embark;
For tho' from out our bourne of Time and Place
The flood may bear me far,
I hope to see my Pilot face to face.*

—Excerpt from “Crossing the Bar” by
Alfred Lord Tennyson, 1809–1892

continued from pg 16

still being attacked, and with vigor at that. Instead, he took to an analogy – that of a physician/medical examiner – and said, ‘Your patient has been mortally wounded. I know not at this time whether he was shot, stabbed, or poisoned, but believe me when I say, the patient is plainly, and utterly dead. Now, if you would like a more thorough post-mortem, with a great deal of effort, I believe I can tell you about how he died, but that does not change the facts of the matter.’ I learned a lot from that experience, how someone who had spent 50+ years as an ivory-tower academic, could still have impact in the “real world.”

Professor Duquette was internationally recognized for his research in the area of corrosion,

electrochemical phenomena, and processing. He was a pioneer in the area of corrosion fatigue and stress-corrosion cracking on metallic materials. He expanded his interests from that early work and was also considered an expert in microbiologically induced corrosion, corrosion in microelectronic films, and containment of high-level radioactive waste through his knowledge of material performance and design practices.

He is the author and co-author of more than 250 scientific publications primarily in the areas of environmental degradation of materials and electrochemical processing of semiconductors. He was the recipient of numerous awards and was elected a fellow to three academic societies including an Alexander von Humboldt Award from the German government. He served on many governmental advisory boards including an appointment to the Nuclear Waste Technology Review Board by President George W. Bush.



*Dave was a very kind, helpful, and
thoughtful person in many people's
professional and personal lives.*

—Walt Johnson '75 & '78



top to bottom, l to r: December 2017 with graduate students Dustin Andersen, Genevieve Kane, Saurabh Pandey, David Duquette, Ainsley Pinkowitz, Varun Sarbada. • With graduate student, Eric Leith, at the department's annual summer picnic at Grafton State Park, June 2018. • ASM Award to Lily Hao Xue Yan, 2016. • Stoloff Award Winners, April 2016. Ed Palermo, Yanhui Huang, Garth Scannell, Pawel Keblinski & David Duquette. • With Michael Moritz and Meeli Leith, May 2018 Class of 2018 Graduation Dinner Celebration. • Lunch with Stoloff Award Winners, April 2017, Dustin Andersen, Jian Shi, Robert Hull, Yiping Wang, David Duquette.

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