THE NEWS
CHEMISTRY
SPRING
2018

SOLVING THE PROBLEM OF PLASTICS

By Anne Manning | Photo by Caroline Power

Tossing a plastic bottle into a recycling bin, rather than throwing it in the trash, is helping to save the planet, right? Don't try that reasoning on Eugene Chen.

The CSU chemistry professor refutes any notion that current recycling practices make a dent in one of humanity's greatest scourges: plastic. By the latest estimates, less than 10 percent of all commercial plastics are recycled, meaning partially reconstituted to extend their usefulness. As a result, Chen says, about 56 million tons of plastic trash are overflowing our landfills and bobbing in our oceans. By 2050, business as usual will mean more plastic than fish by weight in the oceans, according to the World Economic Forum.

Chemistry brought us plastics, and chemistry is now challenged to save us from these synthetic materials and their unintended environmental consequences. Chen and his team are at the forefront of creating new polymer materials, with properties that rival conventional, petroleum-based, nonrecyclable plastics – and are economically viable. They're also redefining what it means to recycle.

"The biggest question is, can we compete?" Chen said. "Will our material be useful? Will it have the properties that rival current, long-lasting, durable plastics? That's the goal."

Chen's CSU research group is one of 11 that recently moved into the new Chemistry Research Building, opened in August. Boasting open, collaborative labs and modern air-handling systems, the state-of-the-art building is advancing cutting-edge synthetic chemistry under its roof every day.

Most work in the Chen lab falls into the category of green and sustainable chemistry: devising environmentally friendly alternatives to traditional chemical products and processes, as well as new polymer materials. Included in these efforts is research to create a novel organic polymer that, after its useful life, can be heated or catalyzed back to its building-block molecule, called a monomer. This, Chen said, would be a truly recyclable material: one with a circular life cycle that produces essentially no waste and recovers the material's value after end use.

Compare that with the synthetic polymers littering Earth today: plastics, rubbers, ceramics, and coatings, among them. Characterized by long chains of repeating units with strong chemical bonds, synthetic polymers are successful for the same reason they are problematic. We love plastics because they're durable and strong; that's also why most of them don't degrade in landfills.

Read the full article in the *Colorado State Magazine*.

MESSAGE FROM THE CHAIR

Today I pen my last introduction to the newsletter, as I will step down on June 30 to make way for our new chair, Professor Matt Shores. I want to take a moment to reflect on the last four years since I started in the role of chair and how much the department has changed over that time. The previous chair, Professor Ellen Fisher continues to serve CSU in her role as Assistant Vice President for Research. My former Associate Chairs, Professor Nancy Levinger, and Associate Professor Melissa Reynolds are just returning from sabbatical and now serving as Associate Dean for Research, respectively. All three of these faculty members continue making substantial contributions to the department and our program. I thank them for their time and energy in their positions.

Other big changes have occurred in these past few years. We have a new building thanks in large part to the tireless efforts of chairs who came before me, Dean Jan Nerger advocating for funding, and the group of faculty who helped design and track construction of this facility. We are also seeing a major upgrade to the Central Instrumentation Facility through funding from the Office of the Vice President for Research that will represent the first of what I hope are many upgrades to the main Chemistry Building. Our graduate program has grown from approximately 170 students to almost 200 Ph.D. students during this time. There are also many new faculty faces among our ranks (five so far – and hoping for a sixth this fall). At the same time, there have been significant losses. Faculty members Mike Elliott, Branka Ladanyi, Marshall Fixman, and Rod Skogerboe all passed away over the last four years and Gary Maciel just before that. Professor Tom Rovis left for Columbia University. While these represent significant holes and people who will be missed, the department continues to prosper. Our faculty continue to be recognized with major awards both within and from outside the University for their efforts in research and teaching, and our students and alumni continue to publish ground-breaking research and excel in their fields. I wish Matt the best of luck and hope I've left the department in a position that will allow him to continue the longstanding tradition of excellence in chemistry at CSU.

Have a great summer!

Charles S. Henry

Charles S. Henry, Ph.D.
Professor and Chair

DEPARTMENT HIGHLIGHTS

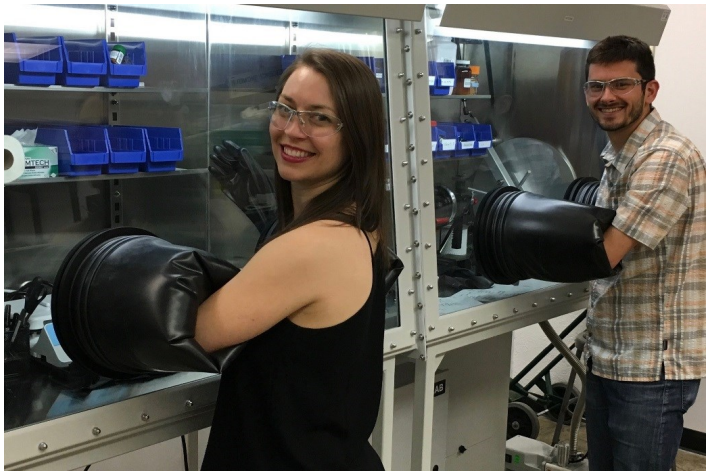
Miyake Named Cottrell Scholar

Colorado State University Assistant Professor of Chemistry Garret Miyake envisions a world with a more sustainable future. His work in synthetic polymer science is helping to bridge the gap between that future and today's reality. His accomplishments in polymer research have not gone unnoticed, most recently earning him the distinguished title of Cottrell Scholar for his project titled "Design Principles of Strongly Reducing Visible-Light Organic Photoredox Catalysts." The Research Corporation for Science Advancement's Cottrell Scholar Award acknowledges only the most outstanding early-career scientists who demonstrate a dedication to both research and academic leadership.
Read more in SOURCE.

Sambur Awarded the 2017 Norman Edmund Inspiration Award

Assistant Professor Justin Sambur was recently awarded the 2017 Norman Edmund Inspiration Award. Sambur's proposed project uses light sheet microscopy to directly visualize solar energy conversion processes along the length of a single nanowire. The long-term goal of this project is to inform materials scientists on how to synthesize the optimal electrode architecture for solar energy conversion applications. To inspire the next generation of scientists to engage in optics and nanoscience, Sambur and his team have developed a LEGO microscope that uses a smart phone camera to image single fluorescent nanoparticles. His team was also featured in the *Collegian* for their research.

CSU Chemistry Students Selected for ACS Editors' Choice



This past December, chemistry researchers from the Neilson Group were selected for the American Chemical Society's Open Access program Editors' Choice in *Chemistry of Materials*.

This publication showcases work by two CSU undergraduate researchers, Juliette Granger (B.S., chemistry, '16) and Andrew Candia (current CSU student). Granger and Candia were trained by CSU graduate student Annalise Maughan to use a combination of chemical routes to synthesize and then characterize these new materials. As these were new materials, the team had to develop their own approaches, bringing together solid-state chemistry, wet-chemistry, and mechano-chemistry to synthesize pure-phase products. Because of the excellent staffing and equipment in the Central Instrument Facility, both Granger and Candia were individually trained to perform their own characterization of their reaction products; this independence enabled them to formulate and test their own hypotheses to deliver the intellectual insights needed for the project's success.

In Maughan and Assistant Professor Jamie Neilson's article, titled "Anharmonicity and Octahedral Tilting in Hybrid Vacancy-Ordered Double Perovskites," they describe the properties of two new materials discovered and synthesized by the CSU undergraduates, (CH3NH3)2SnI6 and (CH(NH2)2)2SnI6. The team used synchrotron X-ray scattering and characterization of the electronic behavior to understand how the atomic structure and its dynamics give rise to these paradigm-shifting properties for solar energy conversion. The work leveraged advanced quantum chemical theory-based calculations performed by collaborators at University College London to arrive at these conclusions. This research is supported by a grant funded by the United States Department of Energy, Office of Science.

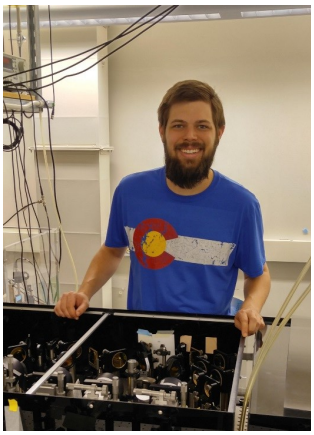
To read more about this story, please visit here. You can also view their featured front cover art for the issue at *Chemistry of Materials*.

Chemistry Alumnus Receives NSF Fellowship

Alumnus Rob Weakly (B.S., chemistry, physics, '14) was recently awarded a National Science Foundation Graduate Research Fellowship for 2018.

The National Science Foundation Fellowship Program recruits high-potential, early-career scientists and supports their graduate research training in science, technology, engineering, and mathematics fields. The 2,000 awardees were selected from more than 12,000 applicants and come from all 50 U.S. states, as well as the District of Columbia and U.S. territories.

During his coursework at CSU, Weakly worked with Associate Professor Amber Krummel, in the Department of Chemistry, as an undergraduate researcher. Weakly was also recipient of the Ruben G. Gustavson Memorial Award in chemistry and received departmental honors in physics. After graduating from CSU, Weakly spent two years teaching high school physics and chemistry in Portland, Ore., while working on his master's degree at the University of Portland. He then taught for another year in Salt Lake City, Utah and decided to return to research. Weakly is currently working in a nonlinear spectroscopy group for Associate Professor Munira Khalil at the University of Washington. His research project focuses on the development of a new fluorescence-based infrared (IR) microscope. Detecting fluorescent light allows scientists to better determine the position of a molecule, and IR light has the energy they need to investigate how the molecules vibrate. Weakly will combine the two by triggering a fluorescence event with low-energy IR light mixed with higher-energy visible light. In his research, Weakly hopes to link position and motion of molecules more closely and in a way not previously done. This is important for determining how different regions of a solid behave.



Weakly's proposal for the NSF fellowship investigates small structures on the surface of new solar cells. Weakly states that he wants to continue his research, remain active in education, and one day to do research at the university level. The fellowship awards funding and tuition over the course of his Ph.D. studies. Weakly says that the main benefit of the program is that it will enable him to focus on research, which for now, is his main goal.

Continuing Their Legacy

The Marshall Fixman and Branka Ladanyi College Professorship in Chemistry Endowment was created in memory of long-time chemistry faculty members Marshall Fixman and Branka Ladanyi. This fund will be used to honor their legacies in ways that support the spirit of the contributions they made to science, including enhancing international collaborations, supporting graduate students and undergraduate research, or any other expenses directly associated with enhancing the education, research, and service mission of the professorship position.

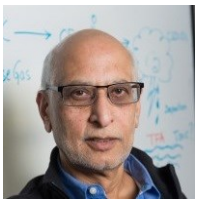
Fixman, a University Distinguished Professor Emeritus, joined the CSU faculty in 1979 with his wife, Branka Ladanyi. Throughout his career, Fixman worked on fundamental problems in polymer physical chemistry. He continually expanded and improved physical theories and mathematical techniques. Professor Fixman earned many honors, including the ACS Award in Pure Chemistry, ACS Award in Polymer Chemistry, APS High Polymer Prize, and election to the U.S. National Academy of Sciences. Through his personal interactions and writings, he taught and inspired several generations of theoretical physical chemists.

Ladanyi was the only female faculty member in the chemistry department for the first eight years she was at CSU. Ladanyi was a faculty member of exceptional talent and a pioneer in her field and for women in academia. Over her career, she contributed profoundly to the theory and modeling of liquids, supercritical fluids, and molecular clusters. Ladanyi served as editor-in-chief of the *Journal of Chemical Physics* and on ACS and APS executive committees.

Fixman and Ladanyi were married for over 41 years and both passed away in early 2016 – Ladanyi in January and Fixman the following month. A biographical memoir of Fixman has been published on the National Academy of Sciences' website to honor his life and career.

To contribute to the endowment, click here, and find the fund in the "select fund" menu.

FACULTY NEWS



Ravishankara Receives U.N. Scientific Leadership Award

This past autumn, A.R. Ravishankara, distinguished professor in the Department of Chemistry and the Department of Atmospheric Science at Colorado State University, received an international Scientific Leadership award from the United Nations Environment Programme (UNEP), the agency that coordinates the U.N.'s environmental activities. The award recognized Ravishankara's lifelong work studying and finding solutions to climate change and ozone layer depletion. The honor was presented at a ceremony in Montreal on the 30th anniversary of the Montreal Protocol.
Read more in SOURCE.

Matthew Shores Named New Chair of Department of Chemistry

Beginning in July, Professor Matthew Shores will take the helm of Colorado State University's Department of Chemistry as its new chair. Shores is keen to build on the success of his predecessor and current chair, Professor Chuck Henry, who has held the position for the past four years. Shores is dedicated to upholding the University's land-grant mission, providing broad, foundational research and learning opportunities. The chemistry department teaches some 70 percent of all students at CSU – an overall number which has grown substantially in the past decade. Shores stated that, "We would love to mirror the growth of the student population." Read more in SOURCE.

SUPPORT THE DEPARTMENT

Your support of the department is incredibly valuable. Please consider making a difference to today's students, faculty, facilities, and programs—at whatever level is right for you. Thank you!

For more information on giving, contact Simone Clasen, Executive Director of Development and Operations

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