

SpotLight

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LAWRENCE LIVERMORE NATIONAL LABORATORY

THE PEOPLE
WHO DRIVE
OUR SCIENCE
AND TECHNOLOGY

GIVING BACK:

LAB SCIENTIST SPURS WOMEN'S INTEREST IN STEM CAREERS

MATERIALS ENGINEER BUILDS
HER OWN PATH TO THE LAB

A GLOBAL PERSPECTIVE:
TACKLING SOME OF THE WORLD'S
TOUGHEST SCIENTIFIC AND TECHNICAL CHALLENGES



WELCOME TO SPOTLIGHT

This new quarterly hard-copy publication highlights the people that make up the Laboratory, from science and technology to business and day-to-day operations. Why do they do what they do, how do they unwind when the work is done for the day, and what really matters the most? Each quarterly issue will feature profiles of LLNL employees who make a difference.

Whether they're conducting basic science or programmatic missions, or ensuring the Lab operates safely and securely, it is the members of the workforce that make the Laboratory unique. *Spotlight* will focus on that with profiles in print, web and social media.

As indicated in last year's communication survey, employees are interested in seeing more feature articles on the diverse minds that make up the Lab. We hope *Spotlight* fits that bill.

*Lynda Seaver
Director, Public Affairs*

*Anne M. Stark
Editor, Spotlight*



SpotLight

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Editor: Anne M. Stark | stark8@llnl.gov | 925-422-9709

Contributing writers for this issue:

Breanna Bishop | bishop33@llnl.gov | 925-423-9802
Charlie Hunts | hunts1@llnl.gov | 925-422-1322
Jeremy Thomas | thomas244@llnl.gov | 925-422-5539

IN THIS ISSUE

Giving back: Expanding Your Horizons conference inspired

Elizabeth Wheeler to go into science 3

A Global Perspective: A worldly workforce drives diverse talents,
thoughts and experiences to the Laboratory 6

Alexandra "Melody" Golobic moves from the kitchen into the lab 9



Elizabeth Wheeler participates in science outreach activities, such as the annual ROTC Day.

GIVING BACK:

Inspired by her own female mentors, LLNL scientist spurs women's interest in STEM careers

By Jeremy Thomas/LLNL

The rolling green hills, coastal landscapes and intermittent foggy mornings notwithstanding, Livermore seemed like a long way from England for a young Elizabeth Wheeler.

The daughter of a British scientist on assignment at Lawrence Livermore National Laboratory, Wheeler, fresh from the climes of Kent, found herself adjusting to life in the U.S. at the age of 11, making new friends and excelling in science and math. The “girl with the cool accent,” Wheeler envisioned becoming a speech therapist, a line of work she had benefited from, and a career considered more suited for women at the time.

But one day, Wheeler, an impressionable middle school student, saw a flier for the Tri-Valley Expanding Your Horizons (EYH), an annual conference that encourages girls and teens to consider career options in science, technology, engineering and math (STEM). It was at Las Positas College, during the keynote speech by the first U.S. female astronaut, Sally Ride, where Wheeler’s stereotypes about scientists were shattered and the foundation for a new path formed.

“When you’re young, you get ideas that scientists are all geeks, and as a teenager, image and wanting to be ‘normal’ is more important than anything else,” Wheeler said. “At EYH, I saw that Sally Ride was quite normal. Seeing her speak and take time out of her day to come out and talk to us really had a big impact on me. Sometimes it’s the little things that make a huge



Lab scientists Elizabeth Wheeler, Heather Enright and Kris Kulp are working on human-on-a-chip technology.

difference. It was seeing, for the first time really, the different options out there.”

Now a deputy division leader in LLNL’s Materials Engineering Division, Wheeler has spent her entire career inspiring, educating and motivating young women and girls to enter STEM careers, at the same time excelling in a mostly male-dominated field.

After graduating from Livermore High, Wheeler attended the University of California at Davis, and although she still had designs on speech therapy, her college experience steered her toward math and chemistry. Despite her obvious talents, Wheeler was occasionally dissuaded from pursuing science by her advisers, one of whom tried unsuccessfully to sway her from taking upper-level math.

“That’s where the stubborn side of me came out,” Wheeler said. “I wanted to be challenged. In hindsight, it kept all the options opened to me.”

Honors chemistry opened the doors to the physical sciences. Chemical engineering, Wheeler said, allowed her to combine her love of chemistry, math, physics and biology, and, following summer internships at Del Monte Foods and Dow Chemical, she graduated from UC Davis with a chemical engineering degree. Then it was on to Stanford University, where she focused her graduate studies on how chemical microstructures change liquids, and earned her master’s and Ph.D., also in chemical engineering.

In 1998, Wheeler began work at the National Ignition Facility as a postdoctoral researcher, implementing her knowledge of optical detection to examine the surfaces and degradation of crystals. By happenstance, she bumped into a fellow Lab scientist she knew from UC Davis, who studied microstructures at the Lab’s Center for Micro and Nanotechnology. Seeking more hands-on work, she leaped at the opportunity to integrate biology with engineering, diving into researching ways to perform polymerase chain reaction (PCR), a DNA-based

**“What I’ve loved
is that I’m never
bored. I’m always
finding interesting
things to do.”**

— Elizabeth Wheeler



Wheeler works with a team of scientists and engineers at the Laboratory to develop human-on-a-chip, a miniature external replication of the human body, integrating biology and engineering with a combination of microfluidics and multi-electrode arrays.

technique for identifying pathogens, viruses and chemicals relying on the rapid copying of genetic information in novel engineering platforms.

“It was just being at the right place at the right time,” Wheeler said of the transition. “It really was the ideal project for me to work on. It applied mass and heat transfer to a biological process. What I’ve loved is that I’m never bored. I’m always finding interesting things to do.”

Years of multiple PCR projects, ranging from taking equipment in the field for testing to low-power usage or Fast PCR, laid the groundwork for her involvement in DNATrax, a non-toxic, DNA-infused aerosol spray of particles that can be traced through the atmosphere to simulate how pathogens, such as anthrax, travel through the air. The technology won a prestigious R&D 100 award — the “Oscars of Innovation” — in 2013. It also sparked interest from the Pentagon, the Department of Homeland Security (DHS) and various transportation agencies.

In 2016, along with DHS and other national labs, Wheeler helped spearhead field tests of the aerosol throughout the New York City subway system, to study how a biological or chemical agent, either inadvertently or purposely released, might disperse through the nation’s largest rapid transit system. The technology also has been patented and commercialized, showing promise in its ability to track everything from a terrorist release of a biological agent, to fraudulent olive oil or a stolen painting — essentially working as a spray-on barcode.

In the past several years, Wheeler has expanded her interest in novel pathogen detection by heading the “human-on-a-chip” (aka iCHIP) project. Wheeler’s team aims to create a miniaturized external replica of the human body, integrating biology and engineering with microfluidics and multi-electrode arrays. The project reproduces four major biological systems vital to life: the central nervous system (brain), peripheral nervous system, the blood-brain barrier and the heart. Once fully developed and integrated, the platform could be used to predict the impacts of

Continued on page 8

A GLOBAL PERSPECTIVE

By Breanna Bishop/LLNL

For more than 60 years, Lawrence Livermore National Laboratory has tackled some of the world's toughest scientific and technical challenges. Each day, our staff applies their expertise to these problems in an effort to make our world a safer place. Lawrence



Sean McCoy
Energy Analyst
Calgary, Canada



Gemma Anderson
Research Scientist
Edinburgh, Scotland



Felicie Albert
Research Scientist
Fontainebleau, France

What I Do: I evaluate the market potential and environmental performance of energy and climate mitigation technologies being developed at the Lab, most notably through the director's Carbon Initiative. I'm also the principle investigator for a California Energy Commission-funded, wood-to-fuel pilot project we are developing with partners at Iowa State University, Easy Energy Systems and Sierra Pacific Industries.

Why LLNL: The opportunity to work on cutting-edge technologies that could have real impact in the world.

What I do: I have been using thousands of simulations, observed data and machine learning to quantify uncertainties in climate models. This type of analysis, known as uncertainty quantification, is important in many different fields of research. I am now part of a strategic initiative LDRD project that will use advanced machine learning techniques to improve predictive models of inertial confinement fusion.

Why LLNL: At age 11, I decided to become a scientist and have never looked back. LLNL has the perfect combination of powerful supercomputers generating tons of interesting data and world-class scientists and engineers who are also friendly and approachable. It also has a strong culture of promoting interdisciplinary research that allows me to work on really cool projects in very different areas. I consider myself incredibly lucky to be a part of it.



Ignacio Laguna Peralta
Computer Scientist
Panama City, Panama

What I Do: I perform research on high-performance computing (HPC). My work focuses on making HPC system and applications more reliable. Lab engineers and scientists use HPC applications to solve complex problems via large-scale numerical simulations — these applications support the Laboratory's programmatic and scientific objectives. Because of the complexity of the software and hardware on which they run, these codes can suffer from errors and bugs that may impact the numerical results that they produce. My work helps programmers to make these applications more resilient to errors as well as to help programmers to debug errors, i.e., to find where they occurred and how to fix them.

Why LLNL: I enjoy the fact that LLNL is a leader and innovator in several advanced technologies, including HPC, my area of expertise. At the Lab, I have access to the largest supercomputers in the world, and I get to interact with the top researchers and practitioners of the field, as well as with scientists of other disciplines. I really enjoy the scientific multidisciplinary environment at the Lab. In addition, the Laboratory's work directly impacts the safety of the country, so it is rewarding that the work I do somehow helps the Lab accomplish its defense and safety missions.



Alfredo Correa
Staff Scientist
Buenos Aires, Argentina

What I Do: I investigate materials properties at the atomic level by computer simulations.

Why LLNL: When I started my Ph.D. program in Berkeley, I learned about opportunities to work at LLNL. The Quantum Simulations Group attracted my attention because it combined two areas of interest I had at the time — computer simulations and quantum physics. I like the possibility to work on diverse types of problems and the freedom I am given to explore techniques to solve these problems.

6,369

Gulf of Mexico

Caribbean Sea

COLOMBIA

Sam Ade Jacobs
Computer Scientist
Lagos, Nigeria

What I Do: I do research focusing on scalable machine learning and big data (graph) analytics with applications in cancer drug discovery (the exascale CANDE and CANCER moonshot projects), global nuclear nonproliferation analysis, National Ignition Facility/Inertial Confinement Fusion large-scale simulation and experimental data and more.

Why LLNL: I was drawn to LLNL because of its focus on high-impact (big science) problems and the availability of (human, hardware and software) resources to address these problems. I enjoy the smart people I work with, the world-class Livermore Computing facility, the emphasis on work-life balance and the beautiful Tri-Valley landscape.

BRAZIL

1

ARGENTINA

SOUTH
ATLANTIC
OCEAN

KEY

Pins indicate number of employees from each country.

*The pins on the map do not represent exact locations of origin.

Livermore's primary mission is ensuring the safety, security and reliability of the nation's nuclear deterrent. However, our portfolio of work stretches far beyond our borders as we work to provide solutions to problems of international importance, such as counterterrorism and nonproliferation, defense and intelligence, energy and environmental security. The challenges of our mission demand that we draw on the widest possible diversity of talents, thought and experiences. Solving these global challenges requires a global perspective, and Livermore proudly draws on the expertise of a global workforce, made up of the best and brightest from more than 40 countries.

We use these sources to probe high energy density science experiments and explore matter in extreme conditions. I conduct a lot of experiments on large-scale laser facilities: the Jupiter Laser Facility and NIF-ARC at LLNL, the Linac Coherent Light Source at SLAC, the OMEGA-EP laser at LLE and the Astra-Gemini Laser at the Rutherford Appleton Laboratory (UK).

Why LLNL: I like the fact that I am surrounded by many, many talented people and great colleagues. If there is something I don't know, there will always be an expert at the Lab that will be able to help me. The environment can be challenging, but it is very stimulating. There is a sense of pride that comes with working at the Lab; I feel like we are all moving in the same direction. This place has allowed me to flourish as a scientist (thanks to a lot of great mentors) and to get recognition I never thought I would have gotten.



Continued from page 5

potentially harmful chemicals, viruses or prescription drugs on human beings without the need for animal or human test subjects.

“PCR is great for detecting if you know what you’re looking for, but how do you detect things if you don’t know what you’re looking for?” Wheeler said. “You have to look at the human response. The iCHIP allows you to know how the human body would respond.”

Wheeler said her team is “not done learning” on the project and is continuing to increase the platform’s complexity and validating how close it is to the human body.

The project has generated broad interest ranging from the medical and pharmacological community to the military and animal rights’ activists — due to its potential to test the effects of pathogens on humans, viruses or prescription drugs without animal studies. Adapting the platform, Wheeler is the engineering lead into a 3D version of the central nervous system (brain-on-a-chip) and leading an effort to grow tumors on microfluidic chips to inform computational models of how cancer propagates and progresses throughout the body.

“If we understand how they correlate, then we know how the human body will respond,” Wheeler said. “If you can get enough data, your computational models can learn how to predict what will happen before it happens — that would have a direct impact on health. If we can understand how brains will be impacted by a chemical, that will help us evaluate countermeasures, having a direct impact on our warfighters.”

“There’s a direct application of what I do to protecting the nation. What I like about my job is I can cover the whole spectrum from research to application, and see it evolve from an idea to something that is actually used to help our nation. It’s an exciting challenge to take something you work on in the labs into the field; it’s no small feat. You have to think about science in a whole new way.”

During a 20-year career where odd hours are the norm, Wheeler has learned to balance the demands of family and work, relying on the support of her extended family and husband, a medical doctor based in San Ramon. When she’s not busying herself in the laboratory, Wheeler enjoys spending time with her two teenaged daughters



Wheeler has been involved in Expanding Your Horizon's since she began leading workshops as a Stanford graduate student.

(one of whom is interested in pursuing bioengineering) and reading historical and science fiction books.

Guiding young women to careers in science has become Wheeler’s passion. She’s been involved in the annual EYH conference since she began leading workshops as a Stanford graduate student. She also has organized career fairs and science expos, served as the conference’s co-chair and co-leads the organization’s special activities program, where she creates challenges to spark girls into thinking about creative problem solving. In addition, Wheeler performs outreach at local schools through Lab-related events such as Science on Saturday, where she’s been a featured speaker. Recently, her lab hired a student intern who became interested in bioengineering after seeing one of her talks.

“I want girls to know the options they have and to not be afraid to go into science like I was,” Wheeler said. “If I can reach even a few people, it’s worth it. Giving back and helping others is part of who I am. But most of all I’m having fun. I’m still challenging myself and I’m loving it.”





MATERIALS ENGINEER BUILDS HER OWN PATH TO THE LAB



By Charlie Hunts/LLNL

Alexandra “Melody” Golobic did not know she wanted to be an engineer. The daughter of an artist and anthropologist, Golobic loved painting and acting, and was always encouraged by her parents to discover. Her path to engineering was not as much about chance as it was being open to exploration.

“My parents let me explore and develop as a person,” Golobic said. Now she explores boundaries and creative solutions in 3D printing, but like most parents of Lab employees, “They aren’t 100 percent sure what I do.”

While she always enjoyed science and math classes in high school, there was never a model of what jobs were available in those fields. Marrying science and her artistic background, Golobic went to culinary school and became a chef at the Sonoma County gem, Willi’s Wine Bar. But after a few years, she wanted to do something more analytical for a living and looked to her love of math. “I wanted to do something that challenged me more than cooking, but still brought out my creativity. The possibilities are endless in the kitchen. I wanted to find that in a lab setting.”

She explored possibilities at a junior college, where she was introduced to engineering by a college counselor. Immediately she was drawn to the hands-on aspect, creative problem solving and working as a team. It was never a question if this was the right direction; engineering was tailor-made to the skills she gathered along the way.





Golobic explains additive manufacturing to students visiting the Lab as part of an Inter-Tribal Energy and Tech Tour.

While an undergrad at Cal Poly San Luis Obispo, Golobic first came to the Lab as an intern and thrived when tasked with solving problems thought impossible. “Research is this uncharted territory that allows you to be really creative and think outside the box,” Golobic said. “Exploring in the labs and the freedom to be creative, like a ‘mad scientist,’ really inspired me.”

Now as a staff materials scientist, she’s working with colleagues on internal outreach for women in her division to talk about developing leadership skills and a support network.

“It’s nice to meet with women who have similar experiences as me,” Golobic said. “Sometimes being a minority within a group can feel like your challenges are yours and yours alone. Meeting people in similar situations can be very empowering.”

The imposter syndrome, something Golobic experiences because of her unconventional background, is prevalent among women in high-achieving positions. She finds meeting other women as a great way to combat that. “You’re reminded that you deserve to be here because of your merits and not simply to fill a quota.”

Representation in and outside of the Lab for others is a top priority for Golobic. She shares her passion for science, technology, engineering and math (STEM) with kids and adults who, like

herself, never considered engineering. “Outreach is something I’ve always felt was important and something I like to be a part of — as a woman, as a minority and having a different background into STEM because it’s not always a linear path,” Golobic said. “Some go to school knowing this is what they want to do, and this is the only thing they’ve ever wanted to be, but I don’t think everyone has that experience. There are all different types of engineers, and you could be one, too.”

She loves the challenge of talking to people who don’t have a science background and getting them excited about STEM. For many people, science in school was abstract and obscure, but Golobic sees science and math as “ways we try to understand the world. There’s a lot of amazing and beautiful things in the world that you can observe directly through science.”

Now settled in the field, she also extends her mentorship and visibility to students and professionals with the Society of Hispanic Professional Engineers and Multicultural Engineering Program at Cal Poly. Many involved in the organizations are the first of their family to attend college and did not have role models in STEM to look to. “They’re working hard to make their dreams come true and they’re paving their own course.”

“The possibilities are endless in the kitchen. I wanted to find that in a lab setting.”

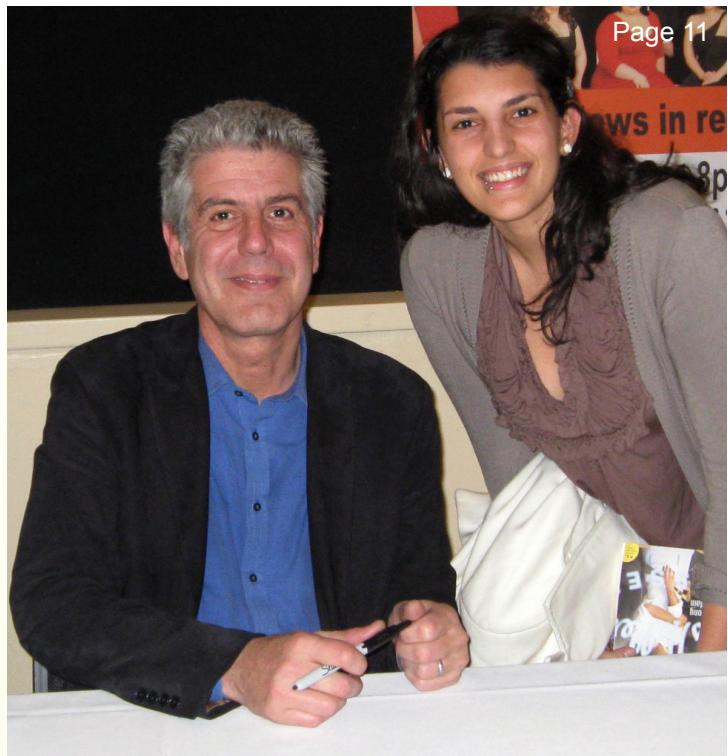
– Alexandra Golobic

While she may not be in restaurant kitchens anymore, Golobic still takes time to connect with her passion for food. The term “foodie” is one she doesn’t take lightly: “I think I’m a foodie in the truest sense of the word.” Her culinary curiosity has taken her to places around the world including Barcelona, where she and a group of friends from her cooking days experienced the trip of a lifetime in 2017, visiting a restaurant listed as one of the top 20 in the world. “It was out of control,” she recalled. “We had 26 courses with wine pairings.

“Barcelona is a place that I dreamt of going to for a long time. It has always felt like a place and culture that fully embodied my interests and personality. When I first started cooking I was really drawn to the Spanish style of eating tapas and the communal aspect of meals in Spain. Amazing foods? Check. Beautiful architecture and art? Check. Passionate people and culture? Check. Nap time? Check.”

But 6,000 miles away, her native Santa Rosa was becoming engulfed by historic wildfires. While her family’s home was spared, her friend’s parents lost their home, the restaurant she worked in burned down and entire sections of the city were gone. “We were in Barcelona on our dream vacation hearing about our entire hometown burning down. It was very surreal,” Golobic said. “Returning home after the trip was really intense and disorienting. So many people barely made it out in time.”

Now that things have settled with her family, she’s immersing back into her routine as a Ph.D. student through the Lab’s distance learning program with the University of California, Davis, and strength training in the gym. “I feel like Wonder Woman every time I lift weights,” Golobic said. “Women are often taught to take up as little space as possible and lifting weights has helped me feel like it’s OK to speak up and embrace my personality.” She still cooks a



Alexandra Golobic with Anthony Michael Bourdain, who is an American chef, author and television personality.

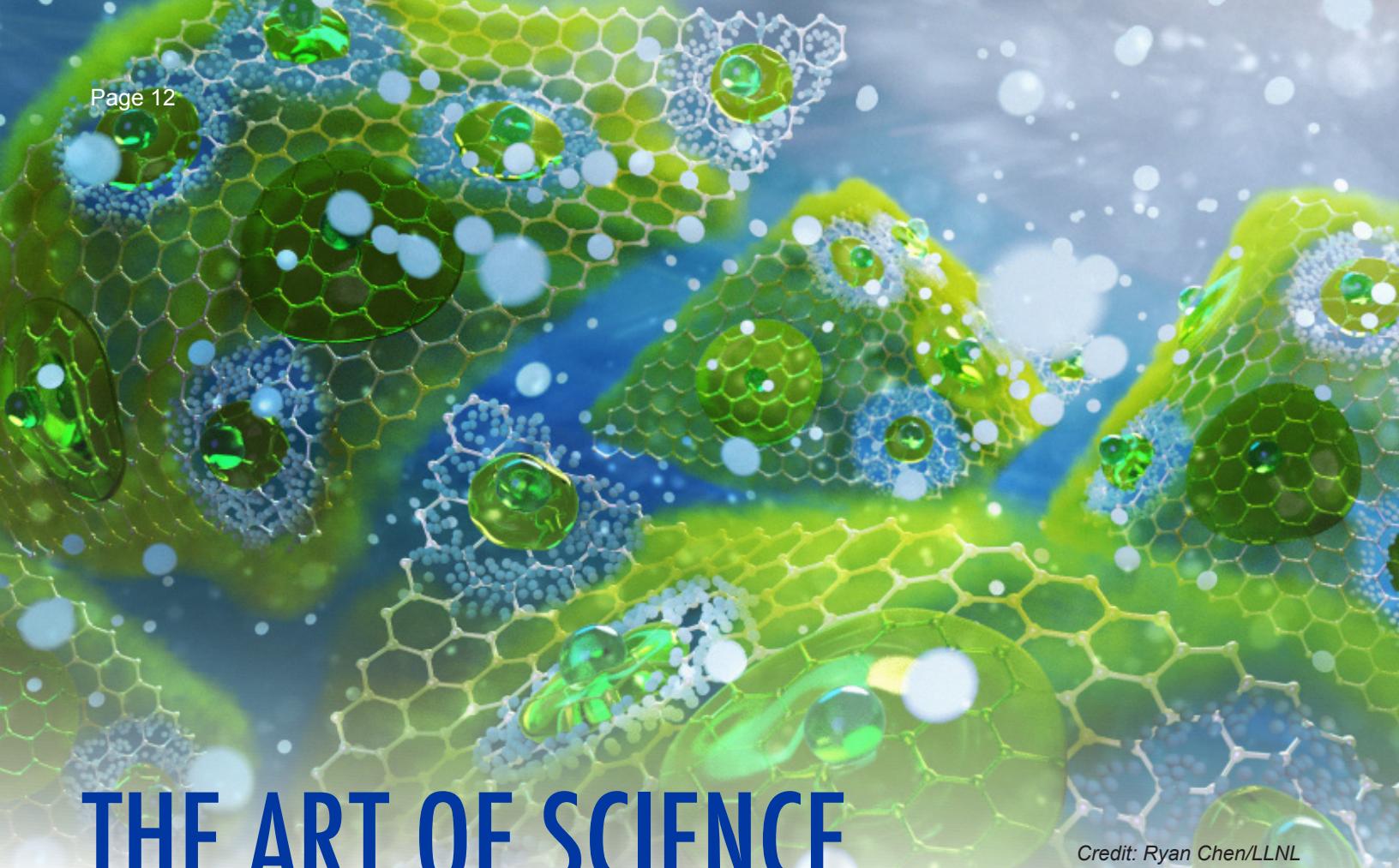
lot, but accepts the challenge to create flavors with less butter and more protein to supplement her workouts.

As for her future research, Golobic is always looking to solve the next difficult or seemingly impossible problem. Nothing is more quintessential in that than space, another of her interests. In fact, her love of the cosmos goes so far that her friends call her a “space doctor,” since during her undergraduate years, she partnered with NASA to create mini-satellites.

Her current work with 3D printing at Lawrence Livermore is harder to describe. “I would love to get funding to do space-related stuff, possibly 3D printing with lunar dust. You could bring a 3D printer to the moon or Mars and build all the infrastructure you need for your colony. It’s such an inhospitable environment, and there’s so much we don’t know about it. So, designing for that and needing 100 percent certainty it’s going to work is amazing.”

No matter where in the cosmos the future takes her, Golobic looks back on her path with the same team spirit she loves about engineering. “For me, the people I work with make my experience and keep me going. I get so much support and encouragement from them. They really make me feel like I can do a lot. I owe a lot to the people that gave me a chance.”

It’s a feeling she pays forward to the next generation every chance she gets.



THE ART OF SCIENCE

Credit: Ryan Chen/LLNL

The Lab's researchers use powerful, state-of-the-art tools to gather scientific detail from every conceivable angle, from larger than life to the atomic scale (such as this image of dirty graphene). Imagery captured from these tools, whether it's one of the world's fastest supercomputers to the most powerful microscope, offers a unique interplay between science and art, and proves that art is more than paint on canvas, ink on paper or carved wood or stone.

"The Art of Science," a look at some of that imagery, is on display in the lobby area of the Bankhead Theater, 2400 First St., Livermore. Also on display, the 3D photography of Lab employee Kirk Sylvester. The show will run through April 30; for gallery hours, contact the Bankhead at (925) 373-6800 or see <https://lvpac.org/>

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