

HOLONYAK HIGHLIGHTS



**HOLONYAK LAB UNIQUELY POSITIONED
TO TAKE ON COVID-19** PG 4-5

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ELECTRONIC COMPONENTS JOIN
FORCES TO TAKE UP 10 TIMES LESS SPACE
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Xiuling Li | INTERIM DIRECTOR'S MESSAGE

When I stepped into the Interim Director role in January, no one could have foreseen the challenges that this year would bring to our University and to the world. But one aspect of this year was no surprise: that Holonyak Micro & Nanotechnology Lab researchers have helped lead the fight against the SARS-CoV-2 virus.

In this annual report, you can read about how HMNTL researchers have collectively worked to provide better, faster, and more cost-effective diagnostics for COVID-19, even as we continue to make remarkable advances in other research areas, such as quantum technology, high speed electronics, and integrated photonics.

We have good reasons to be optimistic about the future. Thanks to funding through the campus Investment for Growth program, we have been working to acquire new cleanroom processing equipment in order to increase our competitive edge. One such piece of equipment is the Elionix ELS-G150 E-Beam Lithography (EBL) System, which is scheduled to arrive this December. It produces the highest accelerating voltage of any such machine worldwide, and will be the first to be installed in North America, enabling state-of-the-art nanoscale research.

With the exciting development of our infrastructure, and more importantly our persistent and creative faculty, staff, and students, HMNTL will thrive in the coming months.

Li named Interim Director

In January 2020, Xiuling Li was named Interim Director of HMNTL.

Li is an internationally-recognized expert and leader in the field of semiconductor nanotechnology. She holds a B.S. from Peking University and a Ph.D. from the University of California, Los Angeles. Li joined the University of Illinois' Department of Electrical and Computer Engineering in 2007. She was promoted to Professor in 2015, and was named a Donald Biggar Willet Professor in Engineering earlier this year. She is a fellow of IEEE, APS, and OSA.

"I am honored and humbled to accept this position," Li said. "I look forward to working with HMNTL faculty and staff to move the lab forward."

MAJOR AWARDS/FELLOWSHIPS



Holonyak celebrated at Parade of Lights

Every year, on the Saturday after Thanksgiving, downtown Champaign glows during the Parade of Lights. It was only fitting that a parade illuminated by LEDs would have the inventor of the red LED, HMNTL namesake Nick Holonyak, Jr., as its grand marshal.

Although Holonyak wasn't able to attend the parade, the hosts held a separate event to declare November 30 as Nick Holonyak Jr. Day and presented him with a trophy that had an LED-lit Christmas tree on top.

Goddard and Li named OSA Fellows

Two HMNTL Professors, Lynford L. Goddard and Xiuling Li, have been named Fellows of the Optical Society (OSA). Goddard and Li, both electrical and computer engineering professors, said the recognition was particularly special because no other university had more than one faculty member elected to the 2020 Fellows class.

Goddard and Li both emphasized that their students' work and their department's support were essential to the research achievements for which they were honored.



Cunningham named Royal Society of Chemistry Fellow

HMNTL Professor Brian Cunningham has been selected as a Fellow of the Royal Society of Chemistry. This honor is given to researchers whose efforts have made outstanding contributions to chemical sciences or have advanced the profession. This achievement is particularly noteworthy due to Cunningham's background in electrical and computer engineering, rather than traditional chemistry.



Gong receives IEEE Ultrasonics Early Career Investigation Award

Associate Professor Songbin Gong was recently honored with the IEEE Ultrasonics Early Career Investigator Award for his group's work with lithium niobate Lamb wave microacoustic devices for radio frequency applications. Gong's group developed novel designs and microfabrication designs to improve the performance of the materials.



MAJOR AWARDS/FELLOWSHIPS

Liu becomes first Lemelson-MIT Student Prize Graduate Finalist from Holonyak Lab



The Lemelson-MIT Program has rewarded exceptional student inventors for the last 25 years and is committed to the belief that invention can solve many economic and social challenges. Some of those challenges are tackled in the work of one of this year's finalists, Holonyak Lab graduate student Richard (Dicky) Liu.

Liu has already patented an invention that lays the foundations of a new LED to be used in the next generation of solid-state-lighting. Liu and adviser Can Bayram developed a new semiconductor crystal that requires less indium to achieve blue and green colors and also triples efficiency.

Fang wins NSF CAREER Award



Assistant Professor Kejie Fang won an NSF CAREER Award for his proposal on cavity-less optomechanics with macroscopic resonances. The prestigious CAREER Awards are given in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the missions of their departments or organizations.

Chen and Zhao receive Google Faculty Research Award



Assistant Professors Yun-Sheng Chen and Yang Zhao recently received the highly competitive Google Faculty Research Award. The awards provide unrestricted gifts to fund world-class technical research. Chen and Zhao's awards will support their research aimed at improving disease prevention, detection, and treatment, through their team unique, innovative photoacoustic imaging technique.

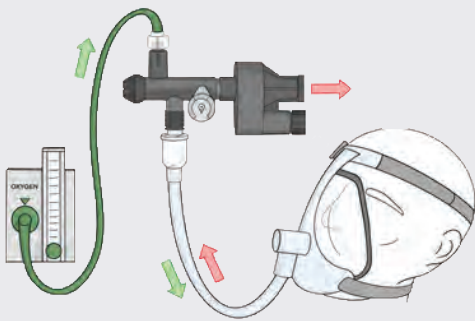
Zhu receives DARPA Young Faculty Award



HMNTL Associate Professor Wenjuan Zhu has received a Young Faculty Award from the Defense Advanced Research Projects Agency (DARPA) for her work with gate dielectrics for high-temperature electronics. Zhu hopes to develop tandem gate dielectrics that can withstand 500°C (932°F) by combining various gate dielectrics layer-by-layer.

KING LEADS EMERGENCY VENTILATOR CREATION

Perhaps the biggest story to come out of the Grainger College of Engineering this spring, was the development of RapidVent, led by Bill King. The prototype emergency ventilator was made to help address the expected surge in the need for respiratory care associated with the COVID-19 pandemic.



“Our team is living the Apollo 13 movie, we have dropped everything else to work around the clock to help respond to the COVID-19 crisis.” said King, overall project leader and Holonyak Lab faculty member. “We have a team of brilliant and dedicated people that made something that actually works in less than one week. It’s very inspiring.”

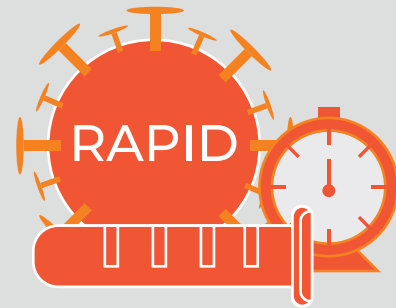


HMNTL UNIQUELY POSITIONED TO TAKE ON COVID-19

When the coronavirus pandemic first hit the United States in March, many researchers turned their attention to work on various aspects of the coronavirus, or SARS-CoV-2. From finding faster and more accurate ways to test for the virus, to developing innovative medical equipment to help hospitals overwhelmed with patients, scientists from a wide range of fields stepped up to contribute to the effort. Among them were many researchers from Holonyak Lab, who used the unique qualities of the lab to their benefit.

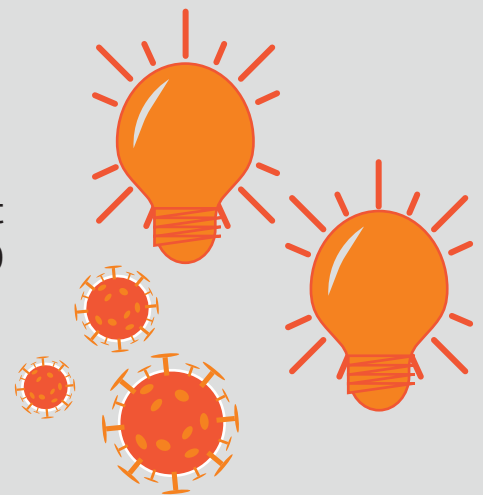
“As one of the only facilities in the country that incorporates both micro and nanofabrication cleanroom facilities and a bionanotechnology Laboratory under the same roof, HMNTL is proud to meet the moment and provide support to COVID-19 related essential research,” said Xiuling Li, HMNTL Interim Director.

Rashid Bashir, Brian Cunningham, and Yi Lu received NSF RAPID Response Research program grants. All of the projects aim to shorten the amount of time it takes to process a COVID-19 test, and to improve the accuracy of the test.



Two faculty, Rashid Bashir and Brian Cunningham, worked together to develop a smartphone-based testing device for viral and bacterial pathogens that takes about 30 minutes to complete a test. The roughly \$50 smartphone accessory could reduce the pressure on testing laboratories.

HMNTL Emertius Professor Gary Eden's start up, Eden Park Illumination, developed a way for ultraviolet light to disinfect crowded places. The company has delivered more than 1,000 disinfecting lights since the pandemic began.



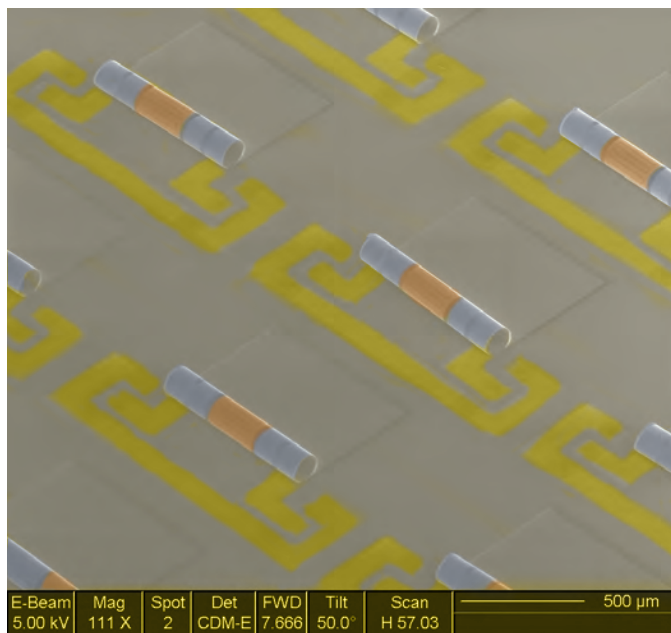
Graduate student Brian D. Li proposed a UV disinfection system to disinfect N95 masks in Haiti for re-use. The project won the Crosslight Best Technological Solution Award.

RESEARCH CONTINUED

Electronic components join forces to take up 10 times less space

Electronic filters are essential to the inner workings of our phones and other wireless devices, but take up space on the chips that researchers are on a constant quest to make smaller. HMNTL researchers have demonstrated the successful integration of the individual elements that make up electronic filters onto a single component, significantly reducing the amount of space taken up by the device.

Led by Interim Director Xiuling Li, the team has ditched the conventional 2D on-chip lumped or distributed filter network design – composed of separate inductors and capacitors – for a single, space-saving 3D rolled membrane that contains both independently designed elements. The work was published in the journal *Advanced Functional Materials*.



HMNTL works to establish Digital Diagnostics Foundry for Cancer Center



The Cancer Center at Illinois (CCIL) is working with the HMNTL to establish a shared-use facility within the Lab called the Digital Diagnostics Foundry. The Foundry will serve as the home for state-of-the-art, commercially available tools for ultrasensitive detection of protein and DNA biomarkers for diseases and health conditions. The goal is for all the tools in the Foundry to be available to research groups across campus to support a wide variety of studies.

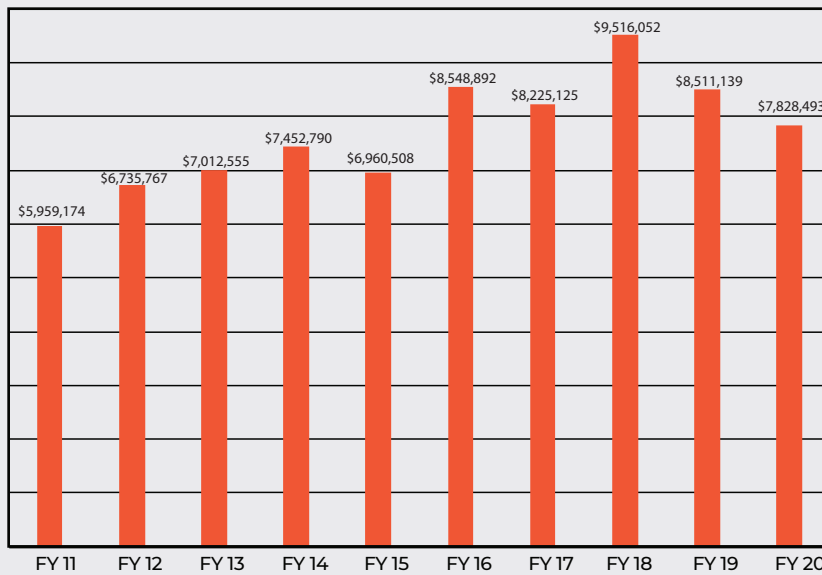
“To have an impact on cancer, engineers need to have collaborations with chemists, biologists, and clinicians who have much more detailed knowledge about cancer genomics and biology,” said Brian Cunningham, Holonyak Lab faculty-member, and Foundry director. “Through our partnership with CCIL, we are working on cancer diagnostics tools and improving cancer diagnosis.”

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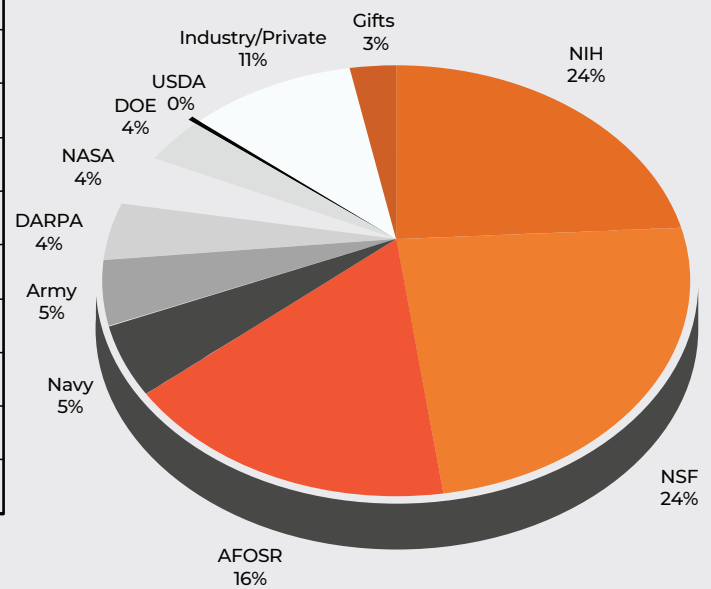
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FINANCIALS

MNTL Research Expenditures



FY20 Research Expenditures



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