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2023 Korea University-Purdue University
Joint Workshop on Advanced Materials and Devices

Korea University, Seoul, July 18th 2023

We are pleased to announce the "2023 Korea University - Purdue University Joint Workshop on Advanced Materials and Devices" a dynamic platform that aims to foster collaboration and exchange of knowledge in the field of advanced materials, analysis, devices, and applications. This workshop will bring together renowned experts and researchers from diverse disciplines to explore cutting-edge advancements and breakthroughs in the realm of bioelectronics, wearable sensors, image sensors, and metamaterials.

The workshop will feature invited speakers who are at the forefront of their respective fields, sharing their expertise, insights, and latest research findings. Through their presentations, participants will gain valuable insights into the latest developments and emerging trends in the field of advanced materials and their multifaceted applications. The workshop will also provide a platform for fruitful discussions, networking opportunities, and potential collaborations among researchers, academicians, and students.

The workshop is supported by Brain Korea Center for Smart Materials and Devices and will be held in New Engineering Hall B104 at Korea University on July 18th 2023.

Time	Title	Speaker
14:50-15:00	Opening Remarks	Prof. Soo Young Kim MSE, Korea University, Chair of BK21 program
15:00-16:00	Wearable Biomedical Devices in Human Healthcare	Prof. Chi Hwan Lee, ME, BME, Purdue University
16:00-17:00	Natural Metamaterials: Seven Functionalities of Silk Proteins	Prof. Young L. Kim BME, Purdue University
17:00-18:00	Smart Medical Devices with µSensors and µActuators	Prof. Hyowon (Hugh) Lee BME, Purdue University
18:00-18:10	Closing Remarks	Prof. Soong Ju Oh, MSE, Korea University

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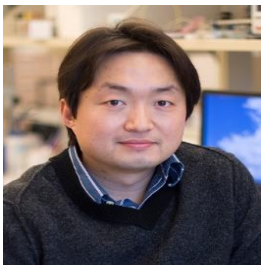
3:00 PM

Wearable Biomedical Devices in Human Healthcare



Chi Hwan Lee, PhD

Leslie A. Geddes Associate Professor of Biomedical Engineering, Mechanical Engineering, and by Courtesy of Materials Engineering and Speech, Language, & Hearing Sciences at Purdue University

Adjunct Professor of Optometry at Indiana University

Abstract:

My laboratory at Purdue University focuses on bridging the critical gap between engineering and unmet clinical needs through the innovation of wearable technologies. Our scholarly efforts are dedicated to addressing this gap using novel yet simple flexible micro-transducers with a clear path towards translation into measurable clinical impacts. We explore a wide variety of wearable biomedical devices that are safely attachable to the skin or eye, enabling continuous remote assessment of human health and chronic diseases. The potential applications of these devices are far-reaching, from healthcare to rehabilitation and telemedicine. In this talk, I will discuss: (1) Sticktronics - sticker-like thin film electronics that are flexibly attachable to the curved surfaces of arbitrary places, increasing the range of industrial and healthcare applications; (2) sensory skin patches that are tailored for various clinical needs of particular urgency in the telemedicine field; (3) smart contact lenses that are built on various commercial brands of soft contact lenses, which could be used to continuously monitor chronic ocular diseases such as glaucoma; and (4) injectable silicon nanoneedles that are built on flexible, biodegradable patches for painless and long-term sustained ocular drug delivery. I will present the results of detailed experimental and theoretical studies to provide insights into each of these topics. At my seminar for the Westwood (President's house) Lecture Series on January 25th 2023, I discussed some of the key aspects of these topics for those who were present.

Biography:

Dr. Chi Hwan Lee is the Lesli A. Geddes Associate Professor of Biomedical Engineering and Associate Professor of Mechanical Engineering, and by Courtesy, of Materials Engineering, and Speech, Language, and Hearing Sciences at Purdue University. He obtained dual B.S. degrees from Industrial Engineering at Ajou University and Mechanical Engineering at Illinois Institute of Technology. He obtained his M.S. and Ph.D. degrees in Mechanical Engineering from Stanford University in 2009 and 2013, respectively. Afterward, he completed a postdoctoral training in the Department of Materials Science and Engineering at the University of Illinois at Urbana-Champaign, under the guidance of Professor John A. Rogers. His research focuses on developing wearable devices to address unmet clinical needs and translate them into measurable clinical impacts. For his notable contributions, Dr. Lee has been honored with prestigious awards such as the 2021 Sensors Young Investigator Award, 2020 Purdue CoE Early Career Research Award, 2019 NIH Trailblazer Award, and 2019 Korean-American Scientists and Engineers Association (KSEA) Young Investigator Award. He has published over 70 journal papers and four book chapters, and issued 5 U.S. patents, filed 11 utility patents, and co-founded four startup companies.

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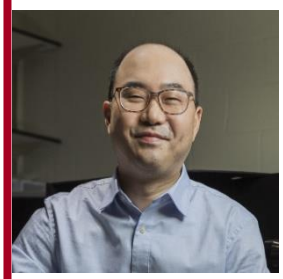
4:00 PM

Natural Metamaterials: Seven Functionalities of Silk Proteins



Young L. Kim

Professor and Associate Head for Research, Weldon School of Biomedical Engineering, Purdue Quantum Science and Engineering Institute
Showalter Faculty Scholar and University Faculty Scholar,
Purdue University
Health Scientist, Centers for Disease Control and Prevention (cdc.gov)

Abstract:
Our research group has been interested in better understanding origins of vibrant, sparkling, and bright appearance in natural/biological media as well as their possible bionanotechnology applications. Objects found in nature often have ‘lustrous’ or ‘silvery’ colors. This type of color appearance drives our research to figure out why such an incredible array of reflections exist in nature, because they must have some biological implications for their survival and existence. Typical nanomaterial hybridizations usually rely on man-made nanomaterials and nanostructures. Oftentimes, such approaches are not only limited by material toxicity and biocompatibility, but also deprive us of scalable, economical, and eco-friendly production for widespread utilization. Fortuitously, we have recently found several unexpected intrinsic functionalities in native silk, produced by silkworms. In this talk, we will share seven lucky seven functionalities of silk that we have recently studied, all of which could potentially lead to a variety of biomedical, energy, and security applications.

Biography:
Young Kim is Professor and Associate Head for Research of Weldon School of Biomedical Engineering at Purdue University. He is a scientist at Centers for Disease Control and Prevention. He has affiliations with Purdue Quantum Science and Engineering Institute, Regenstrief Center for Healthcare Engineering, and Purdue Institute for Cancer Research. His current areas of research include data-centric biophotonics and hybridization of physical and digital properties and physics/biology-informed machine learning. He has successfully managed an atypically broad spectrum of work ranging from cancer research, machine learning, optical imaging, spectroscopy, biomaterials, metamaterials, to cryptographic primitives. Young Kim received his PhD and MSCI (Master of Science in Clinical Investigation) from Northwestern University and postdoctoral training supported by NIH NCI Cancer Research Careers program.

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5:00 PM

Smart Medical Devices with μSensors and μActuators

Hyowon (Hugh) Lee

Director, Center for Implantable Devices
Weldon School of Biomedical Engineering
Purdue University

Abstract:
The development of chronically reliable and multifunctional implantable medical devices is an enormous challenge in biomedical engineering with significant economic and clinical implications. Soon after implantation, implants often suffer from substantial performance degradation and premature failures due to various abiotic and biotic failure modes. Enabling technologies that improve the lifetime of these implantable devices can have an enormous impact on many debilitating chronic neurodegenerative diseases that are difficult to diagnose and treat. In this presentation, I will discuss our latest efforts to utilize thin-film-based microscale sensors and actuators to fabricate self-clearing implantable medical devices for chronic disease management. As a proof-of-concept, I will share our efforts to create chronically implantable self-clearing catheters, glaucoma drainage devices, and novel peripheral nerve interface.

Biography:
Hyowon “Hugh” Lee is an associate professor at the Weldon School of Biomedical Engineering and the Director of Center for Implantable Devices at Purdue University. He received his M.S. and Ph.D. degrees in biomedical engineering from the University of California, Los Angeles, in 2008 and 2011, respectively, under the guidance of Jack Judy. Before joining Purdue, he worked as a senior process engineer for St. Jude Medical’s Implantable Electronic Systems Division where he worked on manufacturing challenges associated with implantable electronic devices such as pacemakers, implantable cardioverter defibrillators, deep brain stimulators, and spinal cord stimulators. His current research interest centers around improving the reliability and functionality of implantable sensors and actuators. He is a recipient of the NSF CAREER award and he recently co-founded two medical devices startups. His lab is supported by NIH, NINDS, NIDA, NSF, Indiana CTSI, Samsung, and Eli Lilly.