Curriculum Vitae

Hui Li, PhD

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Professional hiring

Southern Illinois University Assistant Professor, ECBE, Biomedical engineering	2022.08- present
Johns Hopkins University Post-doctoral fellow, Mechanical engineering	2019.09- 2022.08

Education and professional training

Pennsylvania State University PhD, Biomedical engineering	2015.08- 2019.08
University of Arizona PhD candidate, Mechanical engineering, Advisor	2014.09- 2015.08
Peking University MS, Institute of Microelectronics	2010.09- 2013.07
North University of China BS, Electronic Science and Technology	2006.09- 2010.07

Honors and Awards

- **CHEMINAS Young Researcher Poster Award Winner**, 26th International Conference on **MicroTAS**, 2022. (Online) — 2022
- **Springer Nature Most Popular Papers,** "Viscoelastic solid-repellent coatings for extreme water saving and global sanitation", Springer Nature, 2020. — 2020
- **LESS coating material** is officially archived in Fisher Fine Arts Library at the University of Pennsylvania. — 2020
- Top 10 **SLAS Innovation Award Finalists**, "An Adaptable Microfluidic Platform for Single Cell Pathogen Identification and Antimicrobial Susceptibility Testing", SLAS2020 International Conference & Exhibition, San Diego, CA, USA. — 2020
- Top 10 **NASA iTech Finalists**, "A Zero-Power Biochemical Analysis Platform for Health Monitoring (**SLIPS-LAB**)", National Institute of Aerospace, USA. — 2016
- **Best Paper Award Finalist**, IEEE conference on Micro Electro Mechanical Systems (**MEMS**), San Francisco, CA, USA, 2014. — 2014

GRANT ACTIVITIES

[1] **Illinois Innovation Network**, active period: 10/2024—9/2025.
An integrated sensor system for monitoring the fermentation process in corn silage bunkers
My role: Principal Investigator. Budget: $12,500 (**Awarded**).

[2] **NIH (NIAID) R15**, submitted on Feb. 2025.
Four-hour Sepsis Diagnosis via Integration of Immunocapture, Microfluidics, and Artificial Intelligence
My role: Principal Investigator; Multi-PI: Tragoudas at SIUC. Budget: $556,875 (**Pending**).

[3] **Illinois Innovation Network**, submitted on Feb. 2025.
A Point-of-Care System for Quantitative Detection of HIV RNA in An Extensive Dynamic Range

My role: Principal Investigator; Co-PI: Yu at UIUC. Budget: $40,000 (**Pending**).

[4] **NSF ERI** Grant, submitted on Oct. 2024.
ERI: Innovative Manufacturing for Durable Repellent Coatings
My role: Principal Investigator. Budget: $200,000 (**Pending**).

[5] **USDA** Agriculture and Food Research Initiative, submitted on Sep. 2024.
An integrated system of microfluidics and AI for point-of-care detection of AMR pathogens in food products
My role: Project Director; Co-PD: Lu at SIUC. Budget: $300,000 (Declined).

[6] **SIU Meyers Institute Seed** Grant, submitted on May 2024.
A Nanodroplet System for Rapid Pathogen Diagnosis
My role: Project Investigator. Budget: $12,000 (Declined).

[7] **NIH (NIAID) R15** Grant, submitted on Feb. 2024.
A microfluidic system for rapid pathogen diagnosis
My role: Principal Investigator; Multi-PI: Tragoudas at SIUC. Budget: $444,908 (Declined)

[8] **NIH (NIBIB) R21** Grant, submitted on Feb. 2024.
De-LiPID for durable antifouling design on implantable medical devices
My role: Principal Investigator; Multi-PI: Kim at Mayo Clinic. Budget: $619,419 (Declined).

[9] **NSF ERI** Grant, submitted on Sep. 2023
ERI: Advanced manufacturing of implantable medical devices with durable antifouling property
My role: Principal Investigator. Budget: $199,085 (Declined).

[10] **NIH (NIAID) R15** Grant, submitted on Jun. 2023.
A microfluidic system for rapid pathogen diagnosis
My role: Principal Investigator; Multi-PI: Tragoudas at SIUC. Budget: $445,224 (Declined).

[11] **Congressional Directed Spending**, submitted on Mar. 2023.
Equipment for a Micro/Nano Fabrication Cleanroom at Southern Illinois University Carbondale
My role: Principal Investigator; Participators: Tragoudas, Wang, Ahmed, Lu, Majumder, Kohli, Talapatra, Lee, and Shamsi at SIUC. Budget: $2,352,972 (Declined).

[12] **NIH (NIGMS) R01** Grant, submitted on Feb. 2023.
Pseudouridine-modified RNA probe for label-free biosensing
My role: co-Investigator; PI: Shamsi at SIUC; co-I: Sumita at SIUE.
Budget: $2,327,342 (my budget: $642,066) (Declined).

[13] **NSF REU** Grant, submitted on Sep. 2022.
REU site: Computer-Assisted Methods for Human Health Monitoring
My role: senior personnel; PI: Anagnostopoulos and Tragoudas at SIUC. (Declined).

[14] **NIH (NIAID) Centers of Excellence for Translational Research**, submitted on Sep. 2018
An Integrated Platform for Single Cell Pathogen Identification and Antimicrobial Susceptibility Testing
My role: grant writing trainee. Budget: $23,148,616 (Declined).

[15] **MRI grant at Penn State University**, active period: 07/2018-06/2019.
Nanotube-assisted Microwave Electroporation for Ventilator-Associated Infection Diagnosis
My role: grant writing trainee. Budget: $50,000 (**Awarded**).

[16] **Materials Matter at the Human Level at Penn State University**, submitted in 2018.
SLIPS-LAB - A Point-of-Care System for Urinary Stone Disease Metabolic Workup
My role: grant writing trainee. Budget: $10,000 (Declined).

Publications and Patents

Journal publications:

[1] Hui Li*, and Kun Yin. Advances in Precise Diagnostics and Personalized Medicine. ***SLAS technology*** (2024). (*Corresponding authors, if not otherwise indicated)

[2] Hui Li†, Kuangwen Hsieh†, Pak Kin Wong, Kathleen E. Mach, Joseph C. Liao, and Tza-Huei Wang, Single-cell pathogen diagnostics for combating antibiotic resistance, ***Nature Reviews Methods Primers***, 3, 6 (2023). https://doi.org/10.1038/s43586-022-00190-y. (†Co-first authors, if not otherwise indicated)

[3] Hui Li, Eugene Shkolyar, Jing Wang, Alan C. Pao, Simon Conti, Joseph C. Liao, Tak Sing Wong, and Pak Kin Wong. SLIPS-LAB – A Bioinspired Bioanalysis System for Metabolic Evaluation of Urinary Stone Disease, ***Science Advances***, 6 (21), eaba8535, 2020.

[4] Hui Li, Peter Torab, and Pak Kin Wong. Detection of bacterial infection via a fidget spinner, ***Nature Biomedical Engineering***, 4, 577–578, 2020.

[5] Hui Li, Peter Torab, Kathleen E. Mach, Christine Surrette, Matthew R. England, David W. Craft, Neal J. Thomas, Joseph C. Liao, Chris Puleo, and Pak Kin Wong. An Adaptable Microfluidic System for Single Cell Pathogen Classification and Antimicrobial Susceptibility Testing. ***Proceedings of the National Academy of Sciences of the United States of America (PNAS)***, 116 (21) 10270-10279, 2019.

[6] Jiumei Hu, Liben Chen, Pengfei Zhang, Fan-En Chen, Hui Li, Kuangwen Hsieh, Sixuan Li, Johan H. Melendez, and Tza-Huei Wang. Exploiting $\boldsymbol{\beta}$-Lactams-Induced Lysis and DNA Fragmentation for Rapid Molecular Antimicrobial Susceptibility Testing of Neisseria Gonorrhoeae via Dual-Digital PCR. ***Advanced Science,*** 2024, 2405272. https://doi.org/10.1002/advs.202405272

[7] Fangchi Shao†, Hui Li†, Kuangwen Hsieh, Pengfei Zhang, Sixuan Li, Tza-Huei Wang, Automated and miniaturized screening of antibiotic combinations via robotic-printed combinatorial droplet platform, ***Acta Pharmaceutica Sinica B***, 2023.

[8] Xiaolei Zhu, Shinji Sakamoto, Chiharu Ishii, Matthew D Smith, Koki Ito, Mizuho Obayashi, Lisa Unger, Yuto Hasegawa, Shunya Kurokawa, Taishiro Kishimoto, Hui Li, Shinya Hatano, Tza-Huei Wang, Yasunobu Yoshikai, Shin-ichi Kano, Shinji Fukuda, Kenji Sanada, Peter A Calabresi, Atsushi Kamiya, Dectin-1 signaling on colonic γδ T cells promotes psychosocial stress responses, ***Nature Immunology*** (2023). https://doi.org/10.1038/s41590-023-01447-8.

[9] Hui Li, Pengfei Zhang, Kuangwen Hsieh, and Jeff Tza-Huei Wang, Combinatorial nanodroplet platform for screening antibiotic combinations, ***Lab on a Chip***, doi.org/10.1039/D1LC00865J, 2022.

[10] Fangchi Shao, Pei-Wei Lee, Hui Li, Kuangwen Hsieh and Tza-Huei Wang, Emerging Platforms for High-Throughput Enzymatic Bioassays, ***Trends in Biotechnology***, 2022.

[11] Jiumei Hu, Liben Chen, Pengfei Zhang, Kuangwen Hsieh, Hui Li, and Tza-Huei Wang, A vacuum-driven microfluidic array for multi-step sample digitalization, ***Lab on a Chip***, doi.org/10.1039/D1LC00636C, 2021.

[12] Brian Scherer, Christine Surrette, Hui Li, Peter Torab, Erik Kvam, Craig Galligan, Steven Go, Greg Grossmann, Tyler Hammond, Tammy Johnson, Richard St-Pierre, John R. Nelson, Radislav Potyrailo, Tejas Khire, Kuangwen Hsieh, Jeff Wang, Pak Kin Wong, and Chris M. Puleo, Digital Electrical Impedance Analysis for Single Bacterium Sensing and Antimicrobial Susceptibility Testing, ***Lab on a Chip***, doi: 10.1039/D0LC00937G (2021).

[13] Hui Li, Tyler Garner, Francisco Diaz, and Pak Kin Wong. A Multiwell Microfluidic Device for

Analyzing and Screening Non-Hormonal Contraceptive Agents, ***Small***, 15, 1901910, 2019.

[14] Jing Wang, Lin Wang, Nan Sun, Ross Tierney, Hui Li, Margo Corsetti, Leon Williams, Pak Kin Wong, and Tak-Sing Wong, Viscoelastic solid-repellent coatings for extreme water saving and global sanitation, ***Nature Sustainability***, 2, 1097–1105, 2019.

[15] Hui Li, Michael J. Morowitz, Neal J. Thomas, and Pak Kin Wong. Rapid Single Cell Microbiological Analysis – Toward Precision Management of Infections and Dysbiosis, ***SLAS Technology***, 2019.

[16] Hui Li†, Ye Huang†, Zewen Wei, Wei Wang, Zhenjun Yang, Zicai Liang, and Zhihong Li. An oligonucleotide synthesizer based on a microreactor chip and an inkjet printer, ***Scientific Report***, 9, 5058, 2019.

[17] Jian Gao†, Hui Li†, Peter Torab, Kathleen E. Mach, David W. Craft, Neal J. Thomas, Chris M. Puleo, Joseph C. Liao, Tza-Huei Wang, and Pak Kin Wong, Nanotube Assisted Microwave Electroporation for Single Cell Pathogen Identification and Antimicrobial Susceptibility Testing, ***Nanomedicine: Nanotechnology, Biology, and Medicine***, 17, 246-253, 2019.

[18] Hui Li, Yi Lu, and Pak Kin Wong, Diffusion–reaction kinetics of microfluidic amperometric biosensors. ***Lab on a Chip***, doi:10.1039/C8LC00794B (2018).

[19] Gloria B. Kim, Yongjie Chen, Weibo Kang, Jinshan Guo, Russell Payne, Hui Li, Qiong Wei, Julianne Baker, Cheng Dong, Sulin Zhang, Pak Kin Wong, Elias B. Rizk, Jiazhi Yan, Jian Yang, The critical chemical and mechanical regulation of folic acid on neural engineering, ***Biomaterials***, 178, 504-516, 2018.

Conference and proceedings:

[1] Fangchi Shao, **Hui Li**, Kuangwen Hsieh, Pengfei Zhang and Tza-Huei Wang. “Antibiotic Combination Screening via Robotic Printed Combinatorial Droplet (RoboDrop) Platform”, *The 26th International Conference on Miniaturized Systems for Chemistry and Life Sciences (**MicroTAS**), 2022. (**CHEMINAS Young Researcher Poster Award Winner**)* (*Co-first authors)

[2] Fangchi Shao*, **Hui Li***, Kuangwen Hsieh, Pengfei Zhang and Tza-Huei Wang. “Robotic Printed Combinatorial Droplet (RoboDrop) for Antibiotic Combination Screening”, *The 16th Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems (**NEMS**),* 2022. (online) (*Co-first authors)

[3] **Hui Li**, Pengfei Zhang, Fangchi Shao, Jiumei Hu, Aniruddha Kaushik, Kuangwen Hsieh, and Jeff Tza-Huei Wang, “Droplet platform for screening combinatorial antibiotic therapies”, *The 25th International Conference on Miniaturized Systems for Chemistry and Life Sciences (**MicroTAS**)*, 2021. (online)

[4] Jiumei Hu, Liben Chen, **Hui Li**, Kuangwen Hsieh, Pengfei Zhang, and Tza-Huei Wang, “A vacuum-driven microfluidic array for multi-step sample digitalization”, *The 24th International Conference on Miniaturized Systems for Chemistry and Life Sciences (**MicroTAS**)*, 2020. (online)

[5] **Hui Li**, Jian Gao, and Pak Kin Wong, “A Single Cell Pathogen Identification and Antimicrobial Susceptibility Testing System for Rapid Diagnosis of Infectious Diseases”, ***45th Annual Northeast Bioengineering Conference***, New Brunswick, NJ, USA, 2019. (Oral)

[6] **Hui Li**, Jian Gao, Neal Thomas, and Pak Kin Wong, “Nanotube assisted Microwave Electroporation for Ventilator-Associated Infection Diagnosis”, ***Materials Day***, State College, PA, USA, 2018.

[7] Jing Wang, Nan Sun, Margo Corsetti, **Hui Li**, Lin Wang, Pak Kin Wong, and Tak Sing Wong, “Viscoelastic Solids Repellent Coatings for Extreme Water-Saving”, ***92nd ACS Colloid &***

Surface Science Symposium, State College, PA, USA, 2018. (Oral)

[8] **Hui Li**, Yiming Liu and Pak Kin Wong, “A multiwell microfluidic device for probing the effect of antibiotics on *Mycobacterium* Migration”, *The 21th International Conference on Miniaturized Systems for Chemistry and Life Sciences (**MicroTAS**)*, Savannah, GA, USA, 2017.

[9] Jing Wang, Nan Sun, Margo Corsetti, **Hui Li**, Lin Wang, Pak Kin Wong, and Tak Sing Wong, “Viscoelastic Solids Repellent and Anti-Bacterial Coatings for Extreme Water-Saving”, *Material Research Society Fall Meeting & Exhibit (**MRS**), Boston*, MA, USA, 2017. (Oral)

[10] **Hui Li**, Yi Lu, and Pak Kin Wong, “Rapid Antimicrobial Susceptibility Testing at the Single Cell Level”, ***BMES** Annual Meeting*, Minneapolis, MN, USA, 2016.

[11] Hongze Zhang, **Hui Li**, Mengxi Wu, Huaiqiang Yu, Wei Wang, and Zhihong Li. "3D ICE printing as a fabrication technology of microfluidics with pre-sealed reagents," *2014 IEEE 27th International Conference on Micro Electro Mechanical Systems (**MEMS**)*, San Francisco, CA, 2014, pp. 52-55. (Oral, **Finalist of Best Paper Award**)

[12] **Hui Li***, Ye Huang*, Huaiqiang Yu, Yuan Ma, Zewen Wei, Zicai Liang, Wei Wang, Zhenjun Yang, and Zhihong Li, “High throughput synthesis of oligonucleotide utilizing inkjet printing and micro-reactor array filled with robust opal,” *The 17th International Conference on Miniaturized Systems for Chemistry and Life Sciences (**MicroTAS**)*, Freiburg, Germany, 2013, pp. 1242-1244. (*Co-first authors)

[13] **Hui Li**, Wei Wang, Huaiqiang Yu, Renxin Wang, Zewen Wei and Zhihong Li, "Fabrication of silica opal array with high mechanical strength," *The 8th Annual IEEE International Conference on Nano/Micro Engineered and Molecular Systems (**NEMS**)*, Suzhou, China, 2013, pp. 673-676. (Oral)

Patents:

[1] Pak Kin Wong, **Hui Li**, “Devices, systems, and methods for single cell bacteria analysis”, US Invention Patent, Application No.: US20210322984A1.

[2] Pak Kin Wong, Tak-Sing Wong, Jing Wang, **Hui Li**, Yi Lu, Ying Wan, “Biochemical Analysis Platform”, U.S. Patent No. US11938476B2, Publication on 2024-03-26, Active.

[3] Zhihong Li, Zicai Liang, **Hui Li**, Huaiqiang Yu, Wei Wang, Renxin Wang, “Efficient and High Throughput DNA/RNA Synthesizer based on Silica Opal Array with High Mechanical Strength”, Chinese Invention Patent, Authorized ID: CN-102962015-B, 2012.

RESEARCH EXPERIENCE AND INTEREST

Advanced Pathogen Diagnosis

Bacterial infections pose a critical global healthcare challenge, particularly with the increasing prevalence of antimicrobial-resistant (AMR) pathogens that are no longer responsive to commonly used antibiotics. Currently, bacterial diagnoses rely on standard culture-based methods, which typically require 2 to 5 days to yield results. This significant delay hinders the timely delivery of precise antibiotic treatments, leading to compromised clinical outcomes and contributing to the emergence and spread of AMR pathogens.

To address this issue, we are developing advanced biomedical devices that perform single-cell analysis to accelerate pathogen diagnosis, thus supporting precise antibiotic stewardship. Specifically, these devices detect gene markers and bacteria-antibiotic interactions at the single-cell level, allowing for the identification of bacterial species and their antibiotic resistance profiles within a few hours. For instance, a bacterium grows exponentially when it is resistant to tested antibiotics; whereas its growth can be dramatically inhibited when it is susceptible. Consequently, antibiotic resistance profiles can be determined by monitoring and quantifying such growth over a few cell cycles. To automate the analysis of bacterial growth morphologies, we developed a CNN-based artificial intelligence (AI) model for fast and accurate detection at single-cell resolution. We have

demonstrated such single-cell pathogen diagnosis in diagnosing pathogens responsible for urinary tract infections, sepsis, and polymicrobial infections within less than 3 h – a dramatic reduction in diagnostic time that offers substantial clinical merits.

Liquid-Repellent Surfaces

Liquid-repellent surfaces are of importance in wide-ranging applications, from consumer products to advanced medical and industrial uses, such as waterproofing designs and antifouling implants. Recently, Slippery Liquid-Infused Porous Surfaces (SLIPS), inspired by the *Nepenthes* pitcher plant, were developed by infusing a layer of lubricant fluid into the substrate, creating molecularly smooth liquid surfaces. Such smooth surfaces can repel foreign materials regardless of contact area, withstand physical stress, and self-heal after damage.

We have integrated this SLIPS technique with microfluidics to create a unique bioanalysis device for metabolic evaluation of urinary stone disease—the SLIPS Laboratory (SLIPS-LAB). SLIPS-LAB performs metabolic assessments through multiplex biochemical assays, automating processes such as sample volume metering, reagent mixing, and reaction timing without the need for manual input or additional equipment, enabling point-of-care diagnosis. These capabilities are made possible by the ultra-smooth surface provided by SLIPS, coupled with the innovative microfluidic design. In a pilot study, SLIPS-LAB successfully examined key urinary analytes in clinical samples and evaluated patients' stone risks.

Additionally, we developed a derivative of SLIPS—liquid-entrenched smooth surfaces (LESS)—designed for glass and ceramic surfaces to repel viscoelastic solids (e.g., feces). I contributed to the study of LESS's repellent against bacterial challenges.

Microfluidics in Drug Discovery and Beyond

Microfluidics excels in generating numerous independent assays with minimal reagents, making it a transformative tool in biology, chemistry, and medicine. By miniaturizing conventional experiments and allowing precise control over tiny fluid volumes, microfluidics drives innovation in fields such as drug discovery, diagnostics, and biomolecular analysis.

We have applied this technology across various systems for high-throughput drug screening. For example, we developed a nanodroplet device capable of continuously generating droplets to screen synergistic antibiotic combinations, a crucial approach for repurposing existing antibiotics in the current era of increasing resistance. Additionally, we created a system that supports the parallelized screening of novel nonhormonal contraceptive agents in microwells in an automatic manner. In another project, we employed a microchannel system to investigate the drug response for promoting nerve regeneration. Furthermore, we developed an oligo synthesizer by integrating microwell chips with an inkjet printer, enabling in situ oligo synthesis directly in the microwells.

In addition to the device design, we are interested in developing AI models for massive data analysis, which is critical for identifying meaningful information among enormous data. Similar to the model we designed for bacteria identification, the AI models will be established on CNN configurations for specific projects. We are also exploring models via tools such as ChatGPT.

TEACHING

- **Courses Developed and Offered**

Biomechanics	Fall semesters in 2022, 2023, and 2024
BioMEMS	Fall semesters in 2023 and 2024
Advanced topics in BME control	Spring semester in 2023
Microfabrication of biomedical devices	Spring semester in 2024

- **Previous Teaching Experiences**

  Teaching training from Johns Hopkins Teaching Institute, 2021

  Teaching assistance and guest lecture: Biomedical Instrumentation (3 years), 2017-2019

SERVICES

- **Microfabrication Teaching/Research Laboratory**

  Since joining SIUC, I have established a microfabrication teaching/research lab. The lab is equipped with a mask aligner and its supporting equipment in a small clean room and three 3D printers, allowing for fabrications ranging from 5μm to 10 cm.

- **Reviewer for Grant Proposals**

  NSF SBIR/STTR, 2024.

  Dutch Research Council, Open Technology Program, 2024.

  SIU System Collaborative Grants, 2023.

- **Reviewer for Scientific Journals**

  Biosensors and Bioelectronics, Communications Materials, Microsystems & Nanoengineering, Analyst, Society for Laboratory Automation and Screening, Journal of Micro/Nanolithography, MEMS, and MOEMS, IEEE Transactions on Nanotechnology, Journal of Biological Engineering, Journal of Microelectromechanical Systems, Advanced Materials Letter, Scientific Reports, Frontier in Lab on a Chip Technologies,

- **Editorial Board Member** in SLAS Technology

  Edited a Special Issue in *Advances in Precise Diagnostics and Personalized Medicine* in the journal, *Society for Laboratory Automation and Screening (SLAS) Technology*.

- **Program Committee Member**

  The *17th IEEE International Conference on Nano/Molecular Medicine & Engineering*.