Lai Wei

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Professional Summary

Ph.D. candidate with hands-on expertise in microfluidics, optical instrumentation, rapid microbial diagnostics, and integrated microfabrication. Proven track record in developing high-sensitivity fluorescence detection systems, executing multidisciplinary research, and delivering results through publications, conference presentations, and patented technology. Experienced in end-to-end prototyping, data analysis, and wet-lab validation for biomedical engineering applications.

Technical Skills

- **Microfabrication:** Photolithography, soft lithography, etching, metal deposition, thermal oxidation, silicon doping; contributed to device development used in publications and presentations.
- **Optics & Photonics:** 2D optical simulation; design and validation of laser-induced confocal fluorescence systems (up to 100 mW) with demonstrated single-fluorophore sensitivity.
- **Prototyping & Instrumentation:** Micro-CNC machining (Roland MDX-50, MDA), laser cutting, 3D printing; CAD (AutoCAD, SolidWorks, Fusion 360); thermal/plasma bonding; basic circuit and PCB design.
- **Programming & Data Analysis:** MATLAB for signal/image/video analysis and app development; G-code generation for CNC/laser/3D printing; Arduino for device control and prototyping.
- **Wet Lab Techniques:** Bacterial culture, PCR, gel electrophoresis, gene engineering, fluorescent staining, Western blotting; operation of confocal microscopes and spectrophotometers.
- **Computational Simulation:** 3D CFD, particle tracing, and diffusion/transport modeling using COMSOL for microfluidic system optimization.

Education

Johns Hopkins University — Ph.D. Candidate, Mechanical Engineering (2022–Present)

- BioMEMS & Single Molecule Dynamics Lab (PI: Jeff Wang). Research in microfabrication, rapid diagnostics, microfluidics, and high-sensitivity fluorescence spectroscopy.

The George Washington University — B.S., Biomedical Engineering (2018–2022)

- Nanophotonic & Microfluidics Lab (PI: Zhenyu Li). Focus on microfluidics and optical biosensing.

Patent

- Co-Inventor: Microtiter-plate-based High-Throughput Perfusion Bioreactor (WO2024081794A2, 2024).

Selected Publications

- Wei, L. et al. *Rapid Bacteria Identification and Antimicrobial Susceptibility Testing via 5-Min FISH.* Small (2025). https://doi.org/10.1002/smll.202510292 (Co-first author)
- Wei, L.*, Li, W.* et al. *96-well Perfusion System for High Throughput Tissue Engineering.* Lab Chip (2020). DOI: 10.1039/D0LC00615G (Co-first author)
- McLeod, D.*, Wei, L.* et al. *Microfluidic Perfusion Biofilm Reactor for Optical Analysis.* Biomedical Microdevices (2023). https://doi.org/10.1007/s10544-023-00668-w (Co-first author)

Conference Presentations

- Oral Presentation — SPIE Photonics West (2025): Multidimensional laser induced fluorescent and microfluidic-valve-system-based combinational antibiotics susceptibility screening and sub-5 minute pathogen identification https://doi.org/10.1117/12.3048159
- Oral Presentation — BMES (2024): High-throughput combinational AST and pathogen ID.https://2024bmesannual.eventscribe.net/fsPopup.asp?PresentationID=1501946&mode=presInfo
- Poster Presentations — Five peer-reviewed posters at MicroTAS, BMES, and Global Health Workshop (full list available upon request).

Awards

- Pelton Award for Outstanding Senior Project — GWU SEAS: Developed a handheld microfluidic-enabled infection detection system.