Yuqian (Evelyn) Zhang, Ph.D.

Research Fellow, Mayo Clinic, Rochester, MN, 55905, USA | Permanent Residency

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Personal Profile

Highly motivated researcher with 8 years of experience in developing point-of-care biosensors and biomedical devices in detecting circulating biomarkers, aiming to achieve early disease diagnosis and prognosis. Proven track record of prototyping and optimizing innovative sensing modalities to perform efficient biology sample preparation and detection. Strong leadership skills and excel in collaborating within multidisciplinary teams on various projects.

Core Competencies: electrochemical sensor, electrochemical impedance spectroscopy (EIS), digital microfluidics; electrokinetics; Finite element analysis (FEA).

Education

University of Cincinnati *Cincinnati, OH, USA*

Ph.D in Electrical Engineering *Aug 2015 - Dec 2020*

- GPA: 3.9; Graduate Student Engineer of the Month; University Graduate Scholarship

University of Electronic Science and Technology of China *Chengedu, Sichuan, China*

B.S. in Electrical Engineering *Sep 2011 - Jun 2015*

- GPA: 3.8; People's scholarship; Vice president in Student Union

Skills

Microfabrication	Photolithography, E-beam sputtering, Physical Vapor Deposition, Profilometer, RIE, Plasma Cleaner
Molecular biology	Surface and bioconjugation chemistry, ELISA, PCR, spectrophotometer, western blot, and chromatography
Simulation	COMSOL, Cadence, Multisim, Wolfram Mathematica, Eagle, Proteus, Circuit Maker, Packet Tracer
Structure Design	AutoCAD, Solidworks, Microsoft Visio
Data Analysis	MATLAB, Python, Tensor Flow, R, JMP, Julia
Miscellaneous	Linux, Shell (Bash/Zsh), LaTeX(Overleaf/R Markdown), Tableau, Microsoft Office, Firebase, Git.
Soft Skills	Time Management, Teamwork, Problem-solving, Documentation, Engaging Presentation.

Work Experience

Mayo Clinic *Rochester, MN, USA*

Research Fellow *Jan 2021 - present*

- **Electronic-based sensor integrated with digital microfluidics (DMF) for immunoassay detection**
- Conceptialized an integrated DMF device configured with electrochemical biosensor to achieve the extraction and detection of circulating biomarkers in a simple and automated manner
- Created and implemented experimental strategies for enhancing the functionality and modification of sensor surfaces via forming a self-assembled monolayer (SAM) at gold electrode surface, facilitating the successful binding of bioassays
- Analyzed the electric field distribution of the interdigitated electrode assay using FEA to optimize the electrode design for enhanced detection sensitivity
- Developed a dynamic incubation mode for cell-based immunoassay detection on integrated DMF device, achieving highly sensitive quantification of human peripheral blood mononuclear cell down to 1,000 cells per mL
- Funtionalized a graphene-based 3D matrix structure on electrochemical biosensor to detect soluble PD-L1 protein as low as 1 pg/mL on DMF device
- **An automated DMF device integrated with electrochemical biosensor to capture and quantify the PD-L1 level of tumor derived extracellular vesicles**
- Developed an DMF device to concentration EVs from MDA-MB-231 cell culture media directly within 2 hours by operating magnetic immunoassays in a rapid and programmable manner
- Reduced the sample and reagent consumption during the EV capture procedure, achieving the sample operation at the micro-liter level
- Phenotyped an electrochemcial biosensor on DMF to quantify the PD-L1 expression levels on extracted EVs with series dilution rates (10-10,000) with good linearity ($R^2 = 0.9176$)
- **Technical Skills:** DMF, electrochemcial sensor, physical vapor deposition, E-beam sputtering, COMSOL Multiphysics, surface chemistry, bioconjugation, functionalization of sensor surface, ELISA, western blot, AutoCAD, surface Profilometer.
- **Soft Skills:** Teamwork, Collaboration, Leadership, Communication, Presentation skills.

University of Cincinnati *Cincinnati, OH, USA*

Research Assistant *Oct 2015 - Dec 2020*

- **Sequence-specific detection of nucleic acids utilizing nanopore-based sensor**
- Built and optimized an innovative nanopore-based sensor for the detection of short-stranded microRNAs at fM range with 97.6% detection accuracy.
- Optimized the hybridization conditions for a higher stringency between PNA and miRNA/dsDNA.
- Developed a high-fidelity numerical model of solid-state nanopore in COMSOL to study the fluid flow performance and provided a validation on electroosmosis-based detection principle.
- Created a mathematic model for the analysis of electrokinetics (electrophoresis, electroosmosis and dielectrophoresis) of aqueous solutions and electrokinetic particle separation phenomena.
- Designed and implemented electronic circuits to amplify current signals written in LabVIEW program, and processed signal filtration and fitting with MATLAB.
- **Characterization of exosomes by an electrical impedance spectroscopy (EIS)-based system**
- Developed an impedance measurement system to non-invasively characterize exosomes from body fluids based on the dielectric properties.
- Fabricated a lab-on-chip impedance-based sensor with microfabrication technologies including photolithography, E-beam evaporation and RIE.
- Optimized the encapsulation efficiency of siRNAs in cationic liposomes.
- Established an equivalent circuit model to simulate vesicles in suspension as a function of frequency based on Maxwell's mixing theory.
- Characterized the exosomes with NTA, TEM, western blot, ELISA and bioanalyzer.
- Designed and implemented electronic circuits to amplify current signals written in LabVIEW program, and processed signal filtration and fitting with MATLAB.

Teaching Assistant *Aug 2017 - Apr 2020*

- **Bio-microfluidic Systems**
- COMSOL Multiphysics: simulation on fluid flow performance
- soft lithography fabrication techniques in cleanroom facilities
- **Biomedical Microsystems**
- assisted 40 students with the coursework of the class
- **Technical Skills:** COMSOL Multiphysics, Photolithography, MATLAB, LabVIEW, cell biology, Python (NumPy, Matplotlib, Pandas), surface chemistry, bioconjugation, NTA, DLS
- **Soft Skills:** Leadership, Communication, Presentation skills, Teaching.

University of Electronic Science and Technology of China *Chengdu, Sichuan, China*

Research Assistant *Jan 2013 - June 2015*

- Reviewed the recent findings in the role of electrodes in the low temperature performances of lithium-ion batteries
- Built a mathematical model to simulate the oriented-attachment growth mechanism of nanotubes
- Solvothermal synthesis and characterization of CuInGaS2 nanoparticles with different crystal structures
- **Technical Skills:** Mathematical modelling, material synthesis and characterization (SEM, XRD), Wolfram Mathematica.
- **Soft Skills:** Teamwork, Time Management

Publications

Journal Articles

Multiplex Detection of Infectious Diseases on Microfluidic Platforms

F. Chen, Q. Hu, H. Li, Y. Xie, L. Xiu, Y. Zhang, X. Guo, and K. Yin, Biosensors 13.3 (2023) p.410. 2023

A Digital Microfluidic Device Integrated with Electrochemical Impedance Spectroscopy for Cell-Based Immunoassay

Y. Zhang, Y. Liu, Biosensors 12.5 (2022) p.330. 2022

A Label-Free Electrical Impedance Spectroscopy for Detection of Clusters of Extracellular Vesicles Based on Their Unique Dielectric Properties

Y. Zhang, K. Murakami, V.J. Borra, M.O. Ozen, U. Demirci, T. Nakamura, L. Esfandiari, Biosensors 12.2 (2022) p.104. 2022

Advances in integrated digital microfluidic platforms for point-of-care diagnosis: a review

Y. Zhang, Y. Liu, Sensors Diagnostics (2022). 2022

A rapid bioanalytical tool for detection of sequence-specific circular DNA and mitochondrial DNA point mutations

Y. Zhang, A. Kaynak, T. Huang, and L. Esfandiari, Analytical and bioanalytical chemistry 411 (2019) pp. 1935–1941. 2019

Advancements in microfluidic technologies for isolation and early detection of circulating cancer-related biomarkers

A. Rana, Y. Zhang and L. Esfandiari,Analyst 143.13 (2018) pp.2971–2991. 2018

Sequence-Specific Detection of MicroRNAs Related to Clear Cell Renal Cell Carcinoma at fM Concentration by an Electroosmotically Driven Nanopore-Based Device

Y. Zhang, A. Rana, Y. Stratton, M.F. Czyzyk-Krzeska, and L. Esfandiari, Analytical chemistry 89.17 (2017) pp.9201–9208. 2017

Quantitative estimation of electro-osmosis force on charged particles inside a borosilicate resistive-pulse sensor

M. Ghobadi, Y. Zhang, A. Rana, A., E.T. Esfahani, and L. Esfandiari, IEEE-EMBC (2016) pp.4228–4231. 2016

Simultaneous detection of multiple charged particles using a borosilicate nanopore-based sensor
Y. Zhang and L. Esfandiari, IEEE-NANO (2016) pp.293–296. 2016

Materials insights into low-temperature performances of lithium-ion batteries
G. Zhu, K. Wen, W. Lv, X. Zhou, Y. Liang, F. Yang, Z. Chen, M. Zou, J. Li, Y. Zhang, and W. He, Journal of Power Sources 300 (2015) pp.29–44. 2015

The evaluation of van der Waals interaction in the oriented-attachment growth of nanotubes
W. Jin, W. He, K. Wen, X. Lin, Y. Zhang, H. Cao, Y. Song, W. Lv, and J.H. Dickerson, MRS Online Proceedings Library (OPL) (2014) pp.1705. 2014

Quantitative evaluation of Coulombic interactions in the oriented-attachment growth of nanotubes
Y. Zhang, W. He, K. Wen, X. Wang, H. Lu, X. Lin, and J.H. Dickerson, Analyst 139.2 (2013) pp.371–374. 2013

Conference Presentations

A digital microfluidic device integrated with electrochemical sensor and three-dimensional matrix for detecting PD-L1, Oral
Biomedical Engineering Socity (BMES), Oct 11th-14th 2023, Seattle, WA, USA

A digital microfluidic-based electrochemical impedance spectroscopy for cell-based immunoassay in a dynamic mode, Poster
28th Annual Balfour Surgery Research Symposium, Nov 11th 2022, Rochester, MN, USA

A digital microfluidics-based electrochemical impedance spectroscopy for cell-based immunoassay detection in a dynamic mode, Oral
Miniaturized Systems for Chemistry and Life Sciences (μTAS), Oct.23th- 27th 2022, Hangzhou, China

A microfluidic platform for sensitive bacterial detection in blood through whole genome sequencing within 4 hours, Poster
27th Annual Balfour Surgery Research Symposium, Nov 12th 2021, Rochester, MN, USA

Amplification-Free Detection of Micrornas Related to Clear Cell Renal Cell Carcinoma Utilizing a Novel Nanopore-Based Sensor, Poster
Biophysical Society, Feb 17th- 22th 2018, San Francisco, CA, USA

Biophysical Characterization of Exosomes Based on their Unique Dielectric Properties, Poster
Biophysical Society, Feb 15th- 19th 2020, San Diego, CA, USA

Characterization of exosomes based on their unique dielectric properties by a novel electrical impedance measurement system, Oral
International Society for Extracellular Vesicles, Apr. 24th – 28th 2019, Kyoto, Japan

Characterization of Exosomes Based on Their Unique Dielectric Properties by A Novel Electrical Impedance Measurement System, Poster
Biomedical Engineering Society, Oct. 16th – 19th 2019, Philadelphia, PA, USA

Nanopore based sensor for sequence specific microRNA detection, Poster
Miniaturized Systems for Chemistry and Life Sciences (μTAS), Oct.17th- 23rd 2017, Savannah, GA, USA

Quantitative Estimation of Electro-osmosis Force on Charged Particles inside a Borosilicate Resistive-Pulse Sensor, Poster
IEEE-Engineering in Medicine and Biology Society, Aug 15th-19th 2016, Orlando, FL, USA

Sequence specific microRNA detection by induced electroosmosis flow inside a borosilicate capillary, Poster
Center for Advanced Design Manufacturing of Integrated Microfluidics (CADMIM), Sep. 7th 2016, Cincinnati, OH, USA

Simultaneous detection of multiple charged particles using a borosilicate nanopore-based sensor, Oral
EMBS Micro and Nanotechnology in Medicine Conference, Dec.12th-16th 2016, (Win the second place), Waikoloa, HI, USA

References available upon request.