

Yuqian Zhang, Ph.D.

Postdoctoral Research Fellow, Department of Surgery
Mayo Clinic, Rochester, Minnesota, USA

EDUCATION

Postdoctoral Research Fellow Jan. 2021-present

Mayo Clinic, Rochester, Minnesota, USA

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

University of Cincinnati, Cincinnati, Ohio, USA

Bachelor of Science in Electrical Engineering Sep. 2011- Jun. 2015

University of Electronic Science and Technology of China (UESTC), Sichuan, China

RESEARCH EXPERIENCE

Research Fellow, Mayo Clinic, USA Jan. 2021-present

- Detecting Covid-19-related proteins using electrochemical-based biosensors
- Phenotyping white blood cells for monitoring peripheral immune dynamics using an electrochemical impedance spectroscopy (EIS)-based digital microfluidic (DMF) platform
- Separating bacteria from whole blood of sepsis patients with magnetic beads-based immunoassay, followed by whole genome amplification and sequencing.
- Developing electric cell-substrate impedance sensing (ECIS) platforms to quantify the behavior of cells under different stimulus

Research Assistant, University of Cincinnati, USA Jan. 2016- 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
 - Built 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

➤ ***Fabrication of piezoelectric pressure transducers***

- Fabricated highly sensitive semiconductor pressure sensors with microfabrication technologies
- Tested sensor by analyzing the pressure through voltage change via Wheatstone bridge configuration

PUBLICATIONS

- [1] **Y. Zhang**, Y. Liu, A digital microfluidic device integrated with electrochemical impedance spectroscopy for cell-based immunoassay. *Biosensors*, 2022, 12(5): 330.
- [2] **Y. Zhang**, Y. Liu, Advances in integrated digital microfluidic platforms for Point-of-Care diagnosis: a review. *Sensors & Diagnostics*, 2022.
- [3] **Y. Zhang**, K. Murakami, V. J. Borra, M. O. Ozen, U. Demirci, T. Nakamura, L. Esfandiari, A label-free electrical impedance spectroscopy for characterization of small extracellular vesicles based on their dielectric properties. *Biosensors*, 2022, 12 (2), 104.
- [4] **Y. Zhang**, A. Kaynak, T. Huang, L. Esfandiari. A rapid bioanalytical tool for detection of sequence-specific circular DNA and mitochondrial DNA point mutations. *Analytical and Bioanalytical Chemistry*. 2019;411(10):1935-41.
- [5] A. Rana, **Y. Zhang**, L. Esfandiari. Advancements in microfluidic technologies for isolation and early detection of circulating cancer-related biomarkers. *Analyst*. 2018;143(13):2971-91.
- [6] **Y. Zhang**, A. Rana, Y. Stratton, M.F. Czyzyk-Krzeska, L. Esfandiari. Sequence-Specific Detection of MicroRNAs Related to Clear Cell Renal Cell Carcinoma at fM Concentration by an Electroosmotically Driven Nanopore-Based Device. *Analytical Chemistry*. 2017;89(17):9201-8.
- [7] **Y. Zhang**, L. Esfandiari. Simultaneous detection of multiple charged particles using a borosilicate nanopore-based sensor. *IEEE 16th International Conference on Nanotechnology (IEEE-NANO)*; 2016; 22-25.
- [8] M. Ghobadi, **Y. Zhang**, A. Rana, E.T. Esfahani, L. Esfandiari. Quantitative estimation of electro-osmosis force on charged particles inside a borosilicate resistive-pulse sensor. *38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*; 2016; 16-20.
- [9] G. Zhu, K. Wen, W. Lv, X. Zhou, Y. Liang, F. Yang, Z. Chen, M. Zou, J. Li, **Y. Zhang** and W. He., Materials insights into low-temperature performances of lithium-ion batteries. *Journal of Power Sources*. 2015;300:29-40.
- [10] W. Jin, W. He, K. Wen, X. Lin, **Y. Zhang**, H. Cao, Y. Song, W. Lv, and J. H. Dickerson. The evaluation of van der Waals interaction in the oriented-attachment growth of nanotubes. *MRS Proceedings*. 2014;1705:mrss14-1705-ss05-05.
- [11] **Y. Zhang**, W. He, K. Wen, X. Wang, H. Lu, X. Lin, X. Lin, and J. H. Dickerson. Quantitative evaluation of Coulombic interactions in the oriented-attachment growth of nanotubes. *Analyst*. 2014;139(2):371-4.

POSTER/ORAL PRESENTATIONS

- Miniaturized Systems for Chemistry and Life Sciences (μ TAS), Oct. 23rd – 27th 2022, Hangzhou, China (Oral presentation)
- Biophysical Society, Feb 15th- 19th 2020, San Diego, CA, USA
- Biomedical Engineering Society, Oct. 16th – 19th 2019, Philadelphia, PA, USA.
- Biophysical Society, Feb 17th- 22th 2018, San Francisco, CA, USA.
- Miniaturized Systems for Chemistry and Life Sciences (μ TAS), Oct.17th- 23rd 2017, Savannah, GA, USA.
- Center for Advanced Design & Manufacturing of Integrated Microfluidics (CADMIM), Sep. 7th 2016, Cincinnati, OH, USA.
- EMBS Micro and Nanotechnology in Medicine Conference, Dec.12th-16th 2016, Waikoloa, HI, USA (Oral presentation, win the second place)
- IEEE-Engineering in Medicine and Biology Society, Aug 15th-19th 2016, Orlando, FL, USA.

SKILLS

Micro/Nano-fabrication Techniques

- Nanopore fabrication including nanopipette with programmable laser-based puller, ion-tracked polymer membrane, silicon nitride nanopore and biological nanopore
- Microfluidics – design, fabrication and modeling with theoretical analysis and CFD
- Cleanroom working experience and related instrument operation including photolithography, E-beam evaporation and sputtering, microscope, profilometer, RIE and plasma cleaner
- Characterization techniques including DLS, NTA, AFM and TEM

Molecular Biology

- Cell/bacteria culture, recombinant plasmid production in *E. Coli*
- Endogenous DNA/RNA isolation, purification, amplification and hybridization
- Surface and bioconjugation chemistry for assay development
- Gel electrophoresis, ELISA, PCR, spectrophotometer, western blot, and chromatography
- Synthesis and characterization of siRNA encapsulated liposomes for drug delivery

Software Skills

- Simulation/Programming Tools: COMSOL Multiphysics, LabVIEW, MATLAB, LaTeX
- Data Analysis: Python, R, SQL, Origin and Excel
- Engineering Drawing: AutoCAD, SOLIDWORKS, Rhinoceros and Adobe Illustrator

SELECTED ACTIVITIES AND AWARDS

- Graduate Student Engineer of the Month, University of Cincinnati, OH, USA Oct. 2020
- 2nd Place in the Micro and Nanotechnology in Medicine Paper Competition Dec 2016
- University Graduate Scholarship, University of Cincinnati, OH, USA Aug. 2015 - Aug. 2020
- People's Scholarship, Sichuan, China Aug. 2011- Jun. 2014
- Vice president, Student Union, Sichuan, China Oct. 2011- Jun. 2013