Mutian Wang

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RESEARCH INTERESTS

Wearable devices; Biomarker sensors; Electrochemical characterization; Soft materials; Hardware design; Interstitial fluid extraction; PPG signal acquisition & processing; Mathematical modelling & Machine learning.

EDUCATION

Tianjin University Weighted Average Score: 91.26 / 100 *Sep. 2024 – Present*
M.S. student in Instrument Science and Technology (Expected Jun. 2027, Advisor: Dachao Li & Zhihua Pu)

Shandong University of Technology GPA: 92.3 / 100 *Sep. 2020 – Jun. 2024*
B.Eng. in Measurement and Control Technology and Instrumentation

PUBLICATIONS (8 Peer Reviewed Papers with 5 as First/Co-First Author)

First-authored or co-first-authored papers *(# equal contribution)*

[1] W. Zhu#, **M. Wang**#, J. Li, J. Wang, W. Li, D. Li, H. Zheng, X. Zhang, Z. Pu, "Non-invasive continuous interstitial fluid lactate monitoring via alternating-polarity reverse iontophoresis", *Biosensors and Bioelectronics* 317, 119402 (2026).

[2] **M. Wang**#, W. Zhu#, J. Hou, W. Li, C. Jin, H. Zheng, D. Li, X. Zhang, Z. Pu, "Non-invasive and continuous monitoring of lactate in interstitial fluid for real-time metabolic assessment", *2026 IEEE 39th International Conference on Micro Electro Mechanical Systems (MEMS)*, Salzburg, Austria, 358–361 (2026).

[3] **M. Wang**, X. Liu, W. Han, X. Lin, X. Chen, S. Zhao, Z. Zhuang, L. Zhang, P. Su, "Design of a wearable finger PPG-based blood glucose monitor", *Annals of Biomedical Engineering* 53, 2580–2593 (2025).

[4] **M. Wang**, X. Zhang, W. Zhu, J. Li, J. Wang, D. Li, W. Li, Z. Pu, "Impedance-guided drift correction for long-term hydrogel electrochemical sensors". *2027 IEEE 40th International Conference on Micro Electro Mechanical Systems (MEMS)*, Big Island, Hawaii, USA. (Accepted)

[5] W. Zhu#, **M. Wang**#, J. Li, J. Wang, W. Li, D. Li, H. Zheng, X. Zhang, Z. Pu, "Continuous lactate monitoring via alternating-polarity reverse iontophoresis for exercise metabolism", *2027 IEEE 40th International Conference on Micro Electro Mechanical Systems (MEMS)*, Big Island, Hawaii, USA. (Accepted)

Contributing Author / With Substantial Contribution

[6] W. Zhu, H. Yu, W. Li, X. Li, H. Zheng, C. Li, X. Zhang, C. Jin, **M. Wang**, J. Hou, Y. Liu, Y. Ma, Z. Zhou, M. Deng, P. Guo, M. Li, Z. Song, Z. Pu, D. Li, "pH calibration allows accurate glucose detection in interstitial fluid via reverse iontophoresis", *Nature Communications* 16, 10413 (2025).

[7] J. Wang, H. Zheng, W. Li, W. Zhu, J. Li, Y. Chen, **M. Wang**, Y. Chen, J. Hou, D. Li, Z. Pu, "Geometry-engineered PI–paper microfluidic interface for passive biofluid renewal and long-term wearable biosensing", *Sensors and Actuators B: Chemical* 473, 141194 (2026).

[8] H. Wang*, **M. Wang**, S. Yu, Y. Wang, "Design and kinematic simulation of pipeline flaw-detection robot based on ultrasonic time of flight diffraction", *Journal of Machine Design* 41, 84–90 (2024). (Advisor as first author)

Manuscript under Process

[9] **M. Wang**, X. Zhang, W. Zhu, J. Li, J. Wang, D. Li, W. Li, Z. Pu, "Drift correction in diffusion-constrained hydrogel sensors for continuous electrochemical monitoring". (Manuscript submitted to *Nature Sensors*)

ENGLISH PROFICIENCY

IELTS 6.5 (Listening 8.0; Reading 6.0; Writing 6.0; Speaking 6.5) *Sep. 21, 2026*

RESEARCH EXPERIENCE

Wearable Epidermal Biosensor for Interstitial Fluid Non-Invasive Monitoring

State Key Laboratory of Precision Measurement Technology and Instruments *Sep. 2024 – Present*
Tianjin University, School of Precision Instrument and Opto-Electronics Engineering, China

(1) Hydrogel sensor drift correction [4, 9]

- Investigated molecular interaction caused drift of hydrogel-based electrochemical sensors; proposed impedance driven drift correction method for long-term sensor compensation; wrote manuscript.
- Conducted Molecular Dynamics simulation, COMSOL simulation, hydrogel preparation, screen-printed sensor fabrication, EIS/CA characterizations and microfluidics fabrication.
- The correction strategy reduced current coefficient of variation by 10.3× (glucose) and by 5.4× (H_2O_2) under varied hydrogel thickness and analyte concentration.

(2) Non-invasive lactate detection through reverse iontophoresis (RI) [1, 2, 5]

- Researched alternating-polarity RI for continuous ISF lactate sensing; optimized sampling parameters to suppress Ag/AgCl extraction electrode degradation; designed and fabricated lactate sensors.
- Completed most of *in vitro* and *in vivo* experiments; designed the relay circuit and C/Python scripts for automated measurement; performed most of data processing and figure preparation.
- Leading post-publication translational engineering efforts targeting commercial deployment.

(3) Non-invasive blood glucose detection via reverse iontophoresis (RI) [6, 7]

- Contributed to wearable sensor fabrication, including screen-printing, glucose, Na^+, and pH sensors fabrication and characterization. Assisted with clinical trials and data analysis.
- Led optimizations for commercial translation: RE membrane, interface circuitry, and in-human validation.

Wearable Finger-PPG-Based Non-Invasive Blood Glucose Monitoring System [3]

Shandong University of Technology, School of Mechanical Engineering, China *Sep. 2023 – Jun. 2024*

- Built low-cost finger PPG glucose detection hardware with optical sensor and MCU.
- Developed multi-parameter (MLP) machine learning model for PPG-glucose prediction.
- Performed 24 h continuous test and 99.33% points fell in Clarke Error Grid Zone A and B.
- Led full-cycle work: conception, model derivation, experiments, and manuscript writing.

Kinematics Design & Simulation of Ultrasonic TOFD Pipeline Inspection Robot [8]

Shandong University of Technology, School of Mechanical Engineering, China *Sep. 2021 – Oct. 2022*

- Built D-H kinematic model; simulated pipe-bend tracks in MATLAB Robotics Toolbox; wrote manuscript.

TECHNICAL SKILLS

- **Electrochemistry:** EIS, CA, CV, Tafel, ECSA, sensitivity & selectivity characterization.
- **Simulation:** Materials Studio, COMSOL, MATLAB, Multisim, Proteus.
- **Fabrication:** Screen-printed electrodes, enzymatic and ionic sensors, hydrogels, microfluidics.
- **Hardware:** MCU circuit, relay controlling circuit, Signal reception and processing system.
- **Programming & Data analysis:** Python, C, Origin, machine-learning models (MLP, PINNs).

AWARDS & HONORS

National Scholarship of China.	Top 0.2%, *2023*
Excellent Student of Shandong Province.	Top 0.2%, *2023*
Excellent Graduate of Shandong Province.	Top 4%, *2024*
Special-class Postgraduate Scholarship of Tianjin University.	Top 8.8%, *2024*
First-class Postgraduate Scholarship of Tianjin University.	Top 13.5%, *2025*