

Koosha Karimi

Electrical Engineering

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Rutgers, The State University of
New Jersey, New Brunswick

New Jersey, USA

SHORT BIO

Detail-oriented graduate research assistant currently working towards a degree in Ph.D. with hands-on experience performing theoretical and laboratory work to advance research goals. Drives team success with expertise in data gathering, review, analysis, and reporting. Adept at prepping resources, equipment, and materials for research. Extensive background in investigating electronic devices and methods used for breast cancer diagnosis and treatment.

RESEARCH INTERESTS

- Electronic circuit design, simulation, and implementation
- Micro/Nanomaterials and devices
- Biosensors
- Microfluidics
- Disease diagnosis and treatment

EDUCATION

B.S. Electrical Engineering

University of Tehran, Iran

10/2018 – 2/2023

With a focus on Electronics

GPA: 3.68 (ECE average GPA: 3.32; University of Tehran average GPA: 3.08)

Ph.D. Electrical Engineering
New Brunswick

Rutgers, The State University of New Jersey,

9/2023 - Present

With a focus on Solid State Electronics

GPA: 4

RESEARCH EXPERIENCE

Undergraduate Research Assistant

7/2021 – 9/2023

[Nano Bioelectronics Laboratory \(NBEL\)](#), University of Tehran

Advisor: [Prof. Mohammad Abdolahad](#)

Graduate Research Assistant

9/2023 - Present

[NanoBioTechnology Lab](#), Rutgers University

Advisor: [Prof. Mehdi Javanmard](#)

RESEARCH PROJECTS

Active:

1. Multiplexed COVID DNA nanoballs detection using a microfluidics assay connected to an impedance cytometer **9/2024 – Present**

- Design of multiple DNA nanoballs with various attachments
- Tested the nanoballs using the cytometer detection device
- Analyzed the data to specify the detected DNA nanoballs

Finished:

1. Low Cost, Portable DNA Nanoball Amplification Kit to Integrate with and Perform LAMP Reaction in a Point-of-Care Digital Assay for Rapid Electronic Quantification of Clinical Pathogens Using DNA Nanoballs **9/2023 – 5/2024**

- Designed and Built a Portable DNA Nanoball Amplification Kit: Using Arduino microcontroller and a custom heating module to perform RT-LAMP reactions.
- Tested and Optimized Heating: Developed an efficient heating system with real-time temperature monitoring and a printed microtube holder for accurate positioning.
- Conducted Experimental Tests: Validated the system by performing RT-LAMP reactions with DNA samples and comparing the results against a traditional thermal cycler.
- Integrated Impedance-Based Detection: Used a microfluidic device for detecting DNA nanoballs produced by the kit, ensuring compatibility with your earlier digital assay.
- Analyzed and Compared Results: Demonstrated the effectiveness of your system by comparing the number of detected DNA nanoballs from the kit and a commercial thermocycler, with both showing comparable results.

2. Investigation of and possible use of EChT for treatment of metastasis of breast cancer cells to armpit lymph node **8/2022 – 7/2023**

- Assisted in developing the initial concept of investigating the metastasis of breast cancerous cells to armpit lymph nodes using chips made up of plexies and stopping this event using EChT after extracting enough data from running *in vitro* experiments.
- **Leading in the design and development of the chips using Solidworks** to place the cells and attach the cathode and anode of the EChT device.
- Assembling the chips after manufacturing them out of plexies with lasers.
- Design and implementation of the electric circuit required for applying the DC electric field to the cells on the chips.
- Designing and building the electrodes to apply the dcEF to the cells cultured on the chips.
- Collecting and processing the results and data (pictures, videos, flow cytometry results, etc.) and organizing them for insertion in the paper.
- Running *in vitro* experiments on chips in an incubator with the determined circuit and conditions.

3. Investigation of the phenomenon of breast cancer cells (MCF-7 and MDA-MB-231) invading healthy tissue endothelial cells (HUVEC) under the influence of different DC electric field polarities **7/2021 – 12/2022**

- **Assisted in developing the notion** of applying the external electric field and how to implement it to cancerous and endothelial cells and investigate the invasion phenomenon

under different polarities.

- **Fabricating the chips using the sputtering method.**
- Design and implementation of the electric circuit required for applying the electric field to the cells on the chips.
- Assisted in the design and development of the chips for culturing cells on it.
- Designing and manufacturing the electrodes to apply the dcEF to the tumors on mice.
- **Led running *in vivo* experiments on mice with the designed circuit and electrodes.**
- Collecting and processing the results and data (pictures, videos, pathological data, sonography data, etc.) and organizing them for insertion into the paper.
- Running *in vitro* experiments on fabricated chips in an incubator with the determined circuit and conditions.
- Taking part in writing some paragraphs of the paper.

4. Correlation between glycolytic behavior and cancerous potential in adjacent cavity side margins of breast tumors; cancer-associated fibroblast as an important hallmark
4/2022 – 10/2022

- Assisted in running *in vivo* experiments on mice to evaluate the outcomes.
- Taking part in writing some paragraphs of the paper.
- Gathering and processing the results and data (pictures, videos, pathological data, etc.) and organizing them for insertion into the paper.

5. Efficient treatment of suspicious/involved margins during breast cancer surgery using electrochemical therapy
9/2021 – 9/2022

- **Assisted in developing the initial idea**, and then, **designing and step-by-step improving the apparatus for curing the margins of the tumor**. Running *in vivo* experiments on mice using the apparatus.
- Assisted in implementing the final designs in SolidWorks, and then, manufacturing them.
- Processing the results and data (pictures, videos, pathological data, etc.) and organizing them for inserting in the paper.
- Taking part in writing some paragraphs of the paper.

6. Electrochemical therapy (EChT) of cancer tumor with an external anode, a way to achieve pathological complete response
10/2021 – 9/2022

- **Assisted in developing the initial idea**, and then, **designing and step-by-step improving the apparatus for usage as an external anode for the EChT method** instead of directly attaching the anode to the tissue of the tumor (because of the invasiveness of anode contact and wounds remaining after running the treatment).
- Running *in vivo* experiments on mice using the apparatus to investigate the outcomes.
- Assisted in finding and examining the best material with required specifications to use in manufacturing the apparatus using them.
- Taking part in writing some paragraphs of the paper.
- Gathering and processing the results and data (pictures, videos, pathological data, etc.) and organizing them for insertion into the paper.

7. Facilitated delivery of SPIONS nanoparticles into the cells by reversible electroporation; efficacy and safety in in-vitro and in-vivo models
11/2021 – 8/2022

- **Assisted in developing the initial idea of applying the external magnetic field and how to implement it for the stimulation of iron nanoparticles in the tumor microenvironment.**
- Assisted in finding the best material for deploying the magnetic field.
- Running *in vivo* experiments on mice with the designed circuit and electrodes.
- Designing the circuit and conditions to apply the magnetic field to the Fe nanoparticles injected into mice tumors.
- Taking part in writing some paragraphs of the paper.
- Collecting and processing the results and data (pictures, videos, pathological data, sonography data, etc.) and organizing them for insertion into the paper.

SKILLS

- Teamwork and Collaboration
- Design of Experiment (DoE)
- Database Research
- Digital Signal Processing (DSP), Image Processing, Voice Processing
- Clinical Research
- Technical Writing
- Academic Presentation
- Fabrication (Lithography)
- Data Analysis
- Lab Equipment Operation
- Cleanroom Experience

SOFTWARE

- Circuit Design
 - Cadence
 - Pspice
 - Multisim
 - Hspice
 - Avanwaves
- Digital Signal Processing
 - MATLAB
- Multiphysics Environment
 - COMSOL
- 3D Design
 - SolidWorks
- Microprocessor and Microcontroller Programming
 - Code Vision AVR
 - Proteus
- Hardware Programming (Verilog)
 - Modelsim
 - Quartus
- Microsoft Office
- PCB Design
 - Altium Designer

- Lithography Mask Design
 - L-Edit & S-Edit

HONORS & AWARDS

- **Full scholarship** as tuition and fee waivers, University of Tehran (due to being in the **top 0.1% of best students in the whole county**) 2018 – 2022
- **Ranked 33rd among all accepted undergraduate students** (among the **top 25%**) of the College of Electrical and Computer Engineering at the University of Tehran.
- **Ranked 79th out of 144,437 attendees** (among the **top 0.05%**) in the mathematics field in the 2018 Iranian University Entrance Exam (the overall attendees were over a million people)
- Attended **Alborz High School, One of the first modern high schools in Asia and the Middle East** and one of the top high schools in Tehran

PUBLICATIONS

1. **Karimi, K.**; Fardoost, A.; Javanmard, M. **Comprehensive Review of FinFET Technology: History, Structure, Challenges, Innovations, and Emerging Sensing Applications.** *Micromachines* **2024**, 15, 1187. <https://doi.org/10.3390/mi15101187>
2. **Karimi, K.**; Fardoost, A.; Mhatre, N.; Rajan, J.; Boisvert, D.; Javanmard, M. **A Thorough Review of Emerging Technologies in Micro- and Nanochannel Fabrication: Limitations, Applications, and Comparison.** *Micromachines* **2024**, 15, 1274. <https://doi.org/10.3390/mi15101274>
3. Koosha Karimi, Donal Barrett, Erin Chille, Timothy G. Stephens, Anna Toldra Filella, Haoyu Jiang, Mahtab Kokabi, Debashish Bhattacharya, Vicent Pelechano and Mehdi Javanmard. **Low Cost, Portable DNA Nanoball Amplification Kit to Integrate with and Perform LAMP Reaction in a Point-of-Care Digital Assay for Rapid Electronic Quantification of Clinical Pathogens Using DNA Nanoballs.** Submitted to and published in MicroTAS 2024 conference.
4. Zohreh Sadat Miripour, Mina Aminifar, Parisa Hoseinpour, Fereshteh Abbasvandi, **Koosha Karimi**, Alireza Ghahremani, Mohammad Parniani, Mohammadreza Ghaderinia, Faride Makiyan, Parisa Aghaee, Mohammad Esmaeil Akbari & Mohammad Abdolahad **The presence of cancer-associated fibroblast in breast cavity side margins is in correlation with the expression of oncoproteins by adjacent epithelial cells: a new era in cancerous potential.** *J Cancer Res Clin Oncol* **150**, 421 (2024). <https://doi.org/10.1007/s00432-024-05943-8>
5. Zohreh Sadat Miripour; Fereshteh Abbasvandi; Fahimeh Jahanbakhsh; Mina Aminifar; **Koosha Karimi**; Alireza Ghahremani; Parisa Hoseinpour; Mohammad Parniani; Saeed Abdolhoseini; Mohammad Abdolahad. **“Efficient treatment of suspicious/involved margins during breast cancer surgery using electrochemical therapy”.** Submitted to Medical & Biological Engineering & Computing.
6. Zohreh Sadat Miripour; Alireza Ghahremani; **Koosha Karimi**; Fahimeh Jahanbakhsh; Fereshteh Abbasvandi; Parisa Hoseinpour; Mohammad Parniani; Mohammad Abdolahad.

“Electrochemical therapy (EChT) of cancer tumor with an external anode, a way to achieve pathological complete response”. Published in Medical Oncology.

7. Alireza Ghahremani; Zohre Sadat Miripour; Seyed Mojtaba Yazdanparast; **Koosha Karimi**; Mohammad Ali Khayamian; Mohammad Reza Foroughi-Gilvaei; Pooya Faranoush; Hamed Abadijoo; Parisa Hoseinpour, Mohammad Abdolahad. **“Facilitated delivery of SPIONS nanoparticles into the cells by reversible electroporation; efficacy and safety in in-vitro and in-vivo models”**. Submitted to “Colloids and Surfaces B: Biointerfaces”.
8. Zohreh Sadat Miripour, Mina Aminifar, **Koosha Karimi**, Alireza Ghahremani, Parisa Hoseinpour, Fereshteh Abbasvandi, Mohammad Parniani, Mohammadreza Ghaderinia¹, Faride Makiyan, Sepideh Mansoori, Mohammad Esmail Akbari, Mohammad Abdolahad. **“Correlation between glycolytic behavior and cancerous potential in adjacent cavity side margins of breast tumors; cancer-associated fibroblast as an important hallmark”**. Submitted to “Breast Cancer Research”.

UNDERGRADUATE COURSES

- Microprocessor-Based and Embedded Design (20/20)
- Technical English (20/20)
- Digital Systems 1: Logic Circuits (17.5/20)
- Digital Systems 2: Computer Architecture (18.4/20)
- Electronics 2 (19.8/20)
- Electronics 3 (18.6/20)
- Physiology and Anatomy (19/20)
- Electrical Circuits 1 (16/20)
- Electrical Circuits 2 (14.2/20)
- Systems Analysis (15.3/20)
- Digital Systems Laboratory 1 (15.6/20)
- Digital Signal Processing (DSP) (15.7/20)
- Electrical Machines Laboratory 1 (20/20)
- Electronics Laboratory 1 (19.75/20)
- Electronics Laboratory 2 (19.5/20)
- Electronic Physics (Solid State Electronics) (18.5/20)
- Digital Electronics Circuit (17.75/20)
- Computer Networks (17.75/20)

LANGUAGES

- English (fluent): TOEFL iBT score: 100
- Persian (native speaker)

REFERENCES

- Dr. Mehdi Javanmard | mehdi.javanmard@rutgers.edu | Full professor and Principal Investigator of Nanobiotechnology Lab | Research Advisor | Department of Electrical and Computer Engineering
- Dr. Mohammad Abdolahad | E-mail: m.abdolahad@ut.ac.ir | Associate Professor and Principal Investigator of NBEL | Research Advisor | Department of Electrical and

Computer Engineering

- Dr. Zohreh Sadat Miripour | E-mail: Z.miripour@ut.ac.ir | Project Collaborator and Post-Doctoral Candidate | Department of Electrical and Computer Engineering
- Dr. Alireza Ghelichli | E-mail: Alireza.ghelichli@ut.ac.ir | Project Collaborator and Post-Doctoral Candidate | Department of Electrical and Computer Engineering