

## **Enjoying Engineering in Cancer Detection and Patient Assistance**

Reihaneh Mahdavi received the International Award from the University of Tehran in 2024. This award was granted due to her efforts in Nano-bioelectronics Laboratory, University of Tehran in the field of cancer detection using electric impedance spectroscopy. This research comprised various phases. At the onset of the journey, two diagnostic parameters that could accurately distinguish between benign and malignant breast tissues were introduced for the first time.

In the subsequent stages, the two obtained parameters were employed for the detection of involvement of other organs with cancer, including underarm lymph nodes in breast cancer, monitoring of electrochemical therapy, diagnosis of breast and thyroid tumors requiring surgery during radiology, and thyroid cancer diagnosis during surgery. Various clinical trials were evaluated to implement this assessment.

The results of these studies were published in the prestigious journal "Biosensors and Bioelectronics" with an impact factor of 12.5, and further studies' results were published in international journals such as the "International Journal of Surgery" (IF=15.3), "Nanoscale," "Medical Physics," and "Diagnostics."

Reihaneh Mahdavi obtained her PhD in Electronics Engineering with a specialization in software and semiconductor from the University of Tehran in Nov. 2022. She also completed her bachelor's and master's degrees at Khajeh Nasir Toosi University, and she has been actively involved as a researcher at the Microelectronics Center of the Sharif University of Technology for the past 4 years.

Among the outcomes of these extensive researches, 4 patents have been registered with the United States Patent and Trademark Office, all of which were in the field of cancer detection during sonography or in the operating room. One of the patents was also for the project of monitoring cancerous tumors using EChT or electrochemical therapy.

Furthermore, under the supervision of [Dr. Abdolahad](#) and in collaboration with Dr. Mahdavi, efforts were made for the detection of involvement of lymph nodes in the head and neck, detection of high-frequency margins in breast cancer, and detection of upper gastrointestinal tumors during endoscopy, the results of which are currently being submitted to reputable journals.

Throughout this challenging journey, prominent professors have been present in the team as mentors. [Dr. Abdolahad](#) provided all necessary facilities and conditions for the advancement of these studies and his expertise has been very helpful at all stages. By providing an interdisciplinary network of professors in the fields of surgery, radiology, pathology, and oncology, he created the necessary platform for the targeted and practical implementation of projects, whose benefits could be utilized by the public. His efforts to assist students materially and morally with the products of the projects in which they participated are commendable.

Other professors, such as [Dr. Shamsaldin Mahajerzadeh](#) from the school of Electrical and Computer Engineering at the University of Tehran, and [Dr. Farshid Raeisi](#) from Khaje Nasir Toosi University, have had a significant impact on the growth in this path.

One of the Reihaneh's favorite areas is the technologies and devices of microelectronics and microfluidics in conjunction with biological sciences. Additionally, cancer immunology and the use of electrical methods to assist the patient's immune system in combating cancer, which are also ongoing projects, are among her pursued areas.

Discovering and utilizing the connections of phenomena to solve problems or improve existing methods is one of the attractions of the research world for her, especially when these researches involve topics such as cancer, which annually affects or alters the lives of many people. In her opinion, science and knowledge find their true meaning when they are practical and applicable for improving the lives of others, which is the highest achievement for a researcher.

It is expected that in the near future, the mass production of these diagnostic devices will be facilitated, and their widespread use will be provided. For example, currently, a device for detecting lymph node involvement is being used in various governmental and non-governmental hospitals in Iran. On the other hand, the process of exporting it to India is underway. Two other examples of these inventions that have led to product development are in the process of obtaining medical equipment licenses in Iran, and with the plans made, they can enter the market next year.



Mohammad Abdolahad (right) with Reihaneh (left) with the ELS device at NBEL lab, School of ECE, University of Tehran.