Portable Multi-Parameter Cancer Diagnostic Tool

Tissue characterization at the micro-scale aims to enable cancer diagnosis

This portable cancer diagnostic tool uses a disposable biochip to measure electro-thermo-mechanical properties of tissue as a potential means to identify tumors. By obtaining deterministic and quantitative tissue information, the device aims to measure cancer onset as well as disease progression. Designed initially as a tool for use in breast cancer detection, the innovation has potential for use in other tissue-related cancers.

Georgia Tech's device employs a microelectromechanical system (MEMS)-based sensor array to study changes in the electrical, thermal, and mechanical properties of benign and cancerous tissue. It can be 3D-printed and uses a micromanipulator attached with an indenter that serves as an electrode to be used in electrical characterization. In addition, there is a disposable biochip-integrated sensor module. The 10-mm biochip is integrated with a microheater and a piezoresistive 2-mm sensor array fabricated on an oxidized silicon substrate. The sensor module consists of a space to place tissue samples, the biochip, and connecting pins facilitating the incorporation of the biochip output to a data acquisition card.

The device has been used to demonstrate statistically significant differences between cancerous and normal breast tissues in mechanical stiffness, electrical resistivity, and thermal conductivity.

Summary Bullets

- **Powerful**: Simultaneously measures multiple tissue parameters to determine electro-thermo-mechanical properties
- **Disposable**: Uses single-use biochip components to eliminate cross-contamination
- **Versatile**: Uses a variety of other micromotion-capable actuators and extends to other manufacturing techniques and different length scales

Solution Advantages

- **Powerful**: Simultaneously measures multiple tissue parameters to determine electro-thermo-mechanical properties
- **Disposable**: Uses single-use biochip components to eliminate cross-contamination
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Potential Commercial Applications

- Cancer diagnostics and research
- Biomedical research

Background and More Information

The transformation from benign to cancerous changes a tumor’s morphological signatures. Mechanical and electrical phenotyping have been demonstrated as promising techniques to diagnose pathology and study cancer progression.

MEMS devices are miniature in size and can be batch-fabricated at low cost. The capability of analyzing and manipulating the biological materials at a micro-scale and nano-scale range and the possibility of incorporating them into a portable lab-on-a-chip device makes the MEMS sensors a potential candidate for diagnostic capabilities.

Georgia Tech researchers have developed this system that combines microfabrication technology, 3D-printing technology, reliable packaging, and multifunctional tissue characterization techniques. This system has the potential to improve clinicians’ diagnoses and early intervention strategies for cancer.

Inventors

- Dr. Jaydev Desai
  Director, RoboMed Laboratory and Professor - Georgia Tech Wallace H. Coulter Department of Biomedical Engineering
- Dr. Hardik Pandya
  Former Post-Doc, RoboMed Lab - Georgia Tech
- Dr. Kihan Park
  Former Ph.D. student, Robotics - Georgia Tech

IP Status

Patent application has been filed<o:p></o:p> : US62/353921

Publications

Towards a Portable Cancer Diagnostic Tool Using a Disposable MEMS-Based Biochip, IEEE Transactions on Biomedical Engineering - February 26, 2016

Images

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