Portable Multi-Parameter Cancer Diagnostic Tool (#7619)

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.

Benefits/Advantages

- **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

Potential Commercial Applications

- Cancer diagnostics and research
- Biomedical research

Background/Context for This Invention

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.

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More Information

U.S. Number: 62/353,921

Publications

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

In Breast Cancer, a Potential Partner for Pathologists, Clinical Chemistry, September 1, 2016

Design and Fabrication of a Flexible MEMS-Based Electro-Mechanical Sensor Array for Breast Cancer Diagnosis, Journal of Micromechanics and Microengineering, June 23, 2015

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/portable-multi-parameter-cancer-diagnostic-tool

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot