**Miniature Wearable Sensors Track Subtle Sounds Inside the Body, Provide Information for Continuous Health Monitoring**

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(Photo : Unsplash/ Alexander Grey)

Physicians have long relied on the sounds within the patients' bodies to obtain health information during routine check-ups. These internal sounds - heart beats, movement of air in and out of the lungs, and food digestion - serve as key indicators of a person's well-being. Any subtle changes in these sounds can indicate critical health issues that may require prompt attention.

**Detecting Subtle Body Sounds**

The human body generates different forms of[broadband acousto-mechanical signals](https://pubmed.ncbi.nlm.nih.gov/37973946/) which contain information about a person's cardiorespiratory and gastrointestinal health. These sounds have the potential application for continuous physiological monitoring.

These sounds can also be heard in the form of [noise](https://www.rush.edu/news/understanding-body-noises), such as creaky knees and rumbling stomachs. While these sounds can be embarrassing or annoying, this organic symphony is perfectly normal most of the time. As described by primary care physician Lisa Ravinda from RUSH University, the human body is a living organism, and noises are part of our bodies' functions.

In detecting these body sounds, there are existing device options such as digital stethoscopes and inertial measurement units. Although they offer useful capabilities, they also have some disadvantages like restricted measurement locations which prevent continuous, longitudinal tracking, constraining their use to controlled environments.

**Sound-Capturing Wearables**

At Northwestern University, experts introduced new soft, miniature [wearable devices](https://www.nature.com/articles/s41591-023-02637-5) which can go beyond episodic measurements obtained during medical examinations. Unlike traditional sound detecting devices, these sensors offer continuous wireless monitoring across different regions of the human body.

The devices are compact and lightweight and are attached to the skin to create a non-intrusive sensing network. They contain pairs of high-quality digital microphones and accelerometers which enable them to detect and analyze sounds to map bodily process.

Encased in soft silicone, each device measures 1.6 inches (40 millimeters) long, 0.8 inch (20 millimeters) wide, and 0.3 inch (8 millimeters) thick. Despite its compact size, the sensor is equipped with important features such as Bluetooth connectivity, electronic components for processing, miniature battery, and flash memory.

Meanwhile, the dual-phone setup allows experts to distinguish between internal body sounds and external noises, including ambient sounds and those from adjacent organs. The ambient noise capturing feature not only facilitates noise cancellation, but also collects essential information about the patient's environment.

The idea behind these wearables is to offer highly accurate, continuous evaluation of patient health. It was also developed to help make clinical decisions in the clinics or when patients are admitted to the hospital or attached to ventilators.

In developing these devices, the experts aimed to focus on two particularly vulnerable patient groups: premature infants and adults that recover from surgery. The wearables underwent initial tests involving 15 premature infants who suffer from respiratory and gastrointestinal disorders and 55 adults with 20 chronic lung conditions.

The devices demonstrated clinical-grade accuracy and introduced new capabilities which were not seen before in research or clinical settings. They do not only provide continuous health monitoring, but they also free NICU infants from a number of sensors, cables, and wires which are usually connected to bedside monitors.

A poster of a video game

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INDIANA

Arthur Franklin Mapes

God crowned her hills with beauty,

Gave her lakes and winding streams,

Then He edged them all with woodlands

As the setting for our dreams.

Lovely are her moonlit rivers,

Shadowed by the sycamores,

Where the fragrant winds of Summer

Play along the willowed shores.

I must roam those wooded hillsides,

I must heed the native call,

For a pagan voice within me

Seems to answer to it all.

I must walk where squirrels scamper

Down a rustic old rail fence,

Where a choir of birds is singing

In the woodland . . . green and dense.

I must learn more of my homeland

For it's paradise to me,

There's no haven quite as peaceful,

There's no place I'd rather be.

Indiana . . . is a garden

Where the seeds of peace have grown,

Where each tree, and vine, and flower

Has a beauty . . . all its own.

Lovely are the fields and meadows,

That reach out to hills that rise

Where the dreamy [Wabash River](https://statesymbolsusa.org/symbol-official-item/indiana/state-mineral-rock/wabash)

Wanders on . . . through paradise.

