Transdermal Microneedle Sensors

Exceptional service in the national interest

U.S. DEPARTMENT OF ENERGY

Sandia National Laboratories

Sandia National Laboratories is developing an on-body wearable diagnostic device using minimally invasive microneedles to transdermally access physiological markers for point of care diagnostics, sports medicine, and personalized healthcare applications.

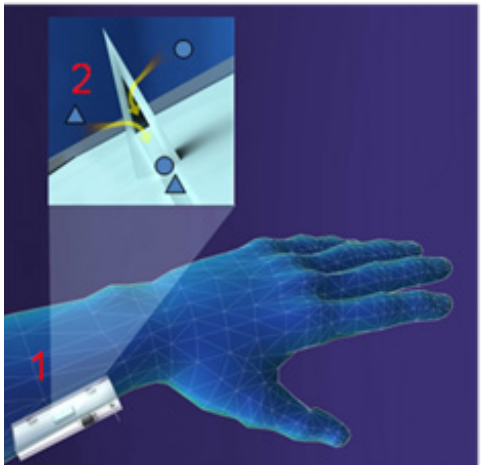
Currently, there are no autonomous and portable diagnostic platforms capable of continuous and remote monitoring of pathophysiological markers. Conventional diagnostic monitoring methods rely on macroscale systems that are undesirable due to requirements for large sample volumes, user operation, fluid transfer between components, and the pain/tissue damage that can result from long-term device/human interactions. Sandia is developing develop a wearable device that can painlessly access interstitial fluid in human skin using microneedles.

Microneedles are advantageous over traditional needles as their size enables minimally invasive interrogation due to their ability to puncture the skin's stratum corneum and access interstitial fluid without irritating deeper layers of the skin associated with pain, blood flow, or sensation. The ability to have a diagnostic device that can be worn and continuously monitor an individual's immediate state of health can reduce the time patients spend in hospitals and doctors' offices, predict disease onset and medical maladies, and provide personalized healthcare analysis.

Right: 1. Minimally invasive microneedle painlessly accesses interstitial fluid

2. Biological analytes are extracted from the interstitial fluid through a hollow bore in the microneedle

3. The analytes are drawn onto a microfluidic chip with embedded sensors for immediate analysis

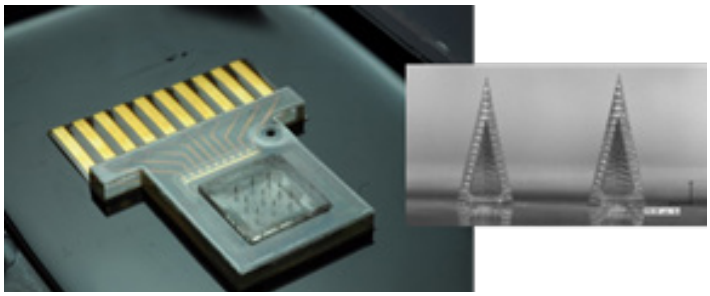


Integrated Microfluidic Microneedle device

We have previously integrated electrode transducers with hollow polymeric microneedles for the detection of ascorbic acid and peroxide, potassium, and the simultaneous detection of glucose, lactate, and pH. Our goal is an integrated microfluidic microneedle device that will enable real-time, long-term, autonomous monitoring of health states that can assess both short and long term trends in an individual's physiology. The platform is also readily adapted for drug injection, making it capable of becoming a "sense-respond" platform.

Commercialization Path

We are seeking commercialization partners to provide funds to do device fabrication, human research activities, and to market. This includes microneedle devices for specific commercial applications and supporting clinical trials for testing and demonstration.



Above: Microneedle diagnostic chip: Nine element microneedle array with fluidic channel interface and gold electrode transducers. In this configuration interstitial fluid can be extracted and run over individual gold electrodes for multiplexed detection of physiological markers. Microneedle size is 800 µm height and 300 µm base.

For more information visit:
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