No Sweat—A New Type of Wearable Patch Can Track Your Health

- A group of researchers at the University of Cincinnati, in partnership with a military research group, has developed a lightweight, wearable patch that works with a smartphone to measure the biomarkers present in sweat.
- The patch collects and gathers data on electrolytes, metabolites, proteins, small molecules and amino acids, all of which can indicate how the body is functioning.
- A drop in electrolyte levels can cause cramps in athletes, for example. Sweat can also provide indications of the presence of a disease, such as cystic fibrosis.

Your sweat can tell a lot about you. It contains electrolytes such as sodium, chlorides, potassium and calcium; metabolites such as lactate, creatinine, glucose and uric acid; small molecules such as amino acids, DHEA (dehydroepiandrosterone) and cortisol; and proteins such as interleukins, tumor necrosis factors and neuropeptides.

Researchers at the University of Cincinnati, in combination with the US Air Force Research Laboratory, have developed a wearable sensor that analyzes biomarkers in sweat and communicates the data to a smartphone.

The patch wicks sweat in a tree-root pattern, in order to maximize the collection area and minimize the amount of paper needed. The researchers outfitted the patch with a sodium sensor, voltage meter, communications antenna, microfluidics and a controller chip, which is externally powered by a smartphone:

Diagram of a Wearable Sweat Sensor

Source: James Provost

The patch uses a technique called iontophoresis, which stimulates the skin to produce sweat, in order to draw sweat out of the skin, so it can be used even on nonathletes.
The patch is able to measure the following biomarkers:

- **Electrolytes**, such as sodium, chlorides, potassium and calcium. An electrolyte imbalance can cause athletes to “crash” and cause cramping. Measuring sodium and chloride in the skin is one method for diagnosing cystic fibrosis.

- **Metabolites**, such as lactate, creatinine, urea and glucose. Lactates show how the body is burning oxygen. Creatinine and urea levels reflect the functioning of the kidneys, and aberrant glucose levels can indicate diabetes.

- **Small molecules**, such as amino acids, DHEA and cortisol. DHEA works counter to cortisol and is the most abundant steroid found in the human bloodstream. It is also a highly reliable biomarker for indicating aging.

- **Proteins**, such as interleukins, tumor necrosis factors and neuropeptides. Small-protein cytokines are released by cells in certain circumstances, including in the presence of trauma, infection and cancer.

While the concept of a sweat-measuring patch has been successfully demonstrated, more work is necessary to improve its sensitivity and configure it to measure multiple electrolytes, metabolites and other biomarkers simultaneously. A patch intended solely for measuring physical exertion would not require FDA approval and therefore could hit the market much sooner than one designed for medical purposes. A second-generation patch under development includes secure Bluetooth communications and features storage and a small microcontroller that performs more complex processing on the data collected by the patch.