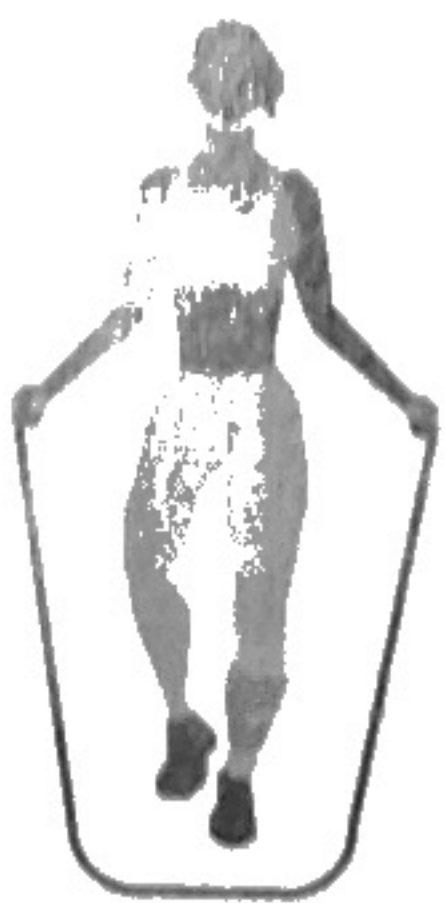


## TECH KNOW

+  
Made to Measure

With a click of the glove, athletes track heart rate painlessly



**SPORTS PERFORMANCE**

testing can be barbaric. Technicians push athletes to their limits and probe and prod them as they exercise. The most meaningful results come from looking inside the athletes. Sometimes researchers use scanners, but sometimes they take blood—lots of it.

In lactate-threshold testing, which determines the maximum exercise level an athlete can sustain, techs draw blood repeatedly while an athlete progressively increases his or her intensity until the point of failure. “People who do lactate [testing] don’t go back to do it frequently,” says BSX Athletics president Dustin Freckleton.

To make the process less painful, Freckleton and his staff have developed the BSXinsight, a wearable



COMPRESSION SLEEVE



INFRARED LIGHTS

device that measures the lactic threshold based on the color of red blood cells—they’re bright red when carrying oxygen, dark red when not. Worn inside a compression sleeve over the calf, the BSXinsight shines infrared light through the skin, then analyzes the color reflected back. The data determines the muscle tissue’s oxygen saturation, or SmO<sub>2</sub>.

“Muscle oxygenation is the linchpin to the energy-producing systems,” says Freckleton. Muscles obtain most of their energy aerobically, i.e., with oxygen. Reduce the oxygen available and muscles begin to switch to anaerobic processes, which produce lactic acid as a by-product. As lactic acid builds up, muscles begin to ache and fatigue, and eventually an athlete has to back off the intensity or even stop. Proper training

can lead to cardiovascular adaptations that increase the body’s ability to deliver oxygen to muscles and flush out lactate, delaying the onset of fatigue. Because a decrease in SmO<sub>2</sub> increases lactic acid production, BSXinsight can relate the two quantities, and measure lactate indirectly, without a needle.

The BSXinsight (which comes in three models that range between \$300 and \$420) also provides a direct value for SmO<sub>2</sub>, a figure that might be more important than the lactate threshold. Live feedback of muscle oxygenation could be used to track individual muscle engagement at any time, determine the ideal length of intervals between exercise repetitions or improve split times on a cycling route by showing where fatigue sets in. All without spilling a drop of blood. —Tom Taylor

## + Smart Socks

■ A spilled cappuccino was all the inspiration Mario Esposito needed. Five years ago, as hot coffee seeped into his socks, he hit upon a way to turn ordinary fabric into a pressure sensor and ordinary socks into smart socks.

In 2011, Esposito, who works at Google, cofounded Sensoria, which produces socks that have two sensors on the forefoot and one on the heel to measure how each foot applies pressure to the ground. This information is relayed along silver fibers to magnetic studs at the top of the sock, where a detachable anklet records the data.

Sensoria’s socks (\$199 for two pairs) do more than record activity. Runners can uncover problems with their stride and test shoes, extracting information about how a shoe affects their foot as it strikes the ground. —T.T.

