

Nevada company, ORNL develop potential lifesaver

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A Las Vegas business and Oak Ridge National Laboratory are improving the odds for people medically at risk from dehydration or congestive heart failure.

The task for ORNL researchers Chuck Britton, Nance Ericson and Gary Alley was to improve and miniaturize Noninvasive Medical Technologies' ZOE, a medical device that monitors a person's hydration, or level of fluid. This is of great importance to members of the military and to thousands of home health care patients, athletes, firefighters and first responders.

“Technologies that allow for better hydration management will improve performance, medical triage and treatment of soldiers and others who are suffering from a fluid-electrolyte imbalance,” said Katy DeMarr, vice president, government relations of Noninvasive Medical Technologies.

As basic as it may seem for people to maintain proper levels of fluid, in practice it is not so simple as nationwide each year hundreds of people either die or suffer ill effects because of dehydration.

“Studies have shown that up to 80 percent of troops become dehydrated while performing their duties, and that's a major concern to the military because the soldiers are not able to perform at peak levels,” DeMarr said. “Similarly, high school and college athletes would benefit greatly from knowing their hydration levels.”

While Noninvasive Medical Technologies has a ZOE on the market, used primarily in home health care applications, the company's goal was to improve upon the product by making it more robust, smaller, less expensive and able to be monitored remotely.

DeMarr said her company sought out ORNL because of its expertise and stellar reputation in the areas of chip design. The project has progressed rapidly as Britton and Ericson, members of the lab's Engineering Science and Technology Division, began work about a year ago and clinical trials for the new device were completed last month.

"Our key contributions were to reduce the system to an integrated circuit, or chip, to reduce the amount of power needed to operate the unit and to lower the cost," Ericson said.

"Before we could do that, however, as a team we had to better understand the product as a circuit that has to operate in a wide range of temperatures yet maintain a high degree of accuracy," Britton said.

The ZOE Fluid Status Monitor measures thoracic base impedance, which is a measurement of the electric current traveling from the top to the bottom of the thorax. This is accomplished by placing one electrode at the top and another at the bottom of the breastbone. The less resistance – measured in ohms – the more fluid in the chest. The normal range for people is between 19 ohms and 30 ohms. Values lower than 19 indicate that a person may be overhydrated while values exceeding 30 indicate dehydration.

"The measurement is a quick and easy method to determine whether a person is experiencing fluid congestion or dehydration," DeMarr said. "Studies have shown that Z_o , or the base resistance, is an early predictor of congestion in heart failure, showing decreases as early as two weeks prior to weight gain and other symptoms."

A wearable wireless version of the ZOE instrument, ZOEWi, will allow monitoring during activity and is planned for market introduction in 2008, according to Jeremy Copeland, vice president of marketing for Noninvasive Medical Technologies.

Source: Oak Ridge National Laboratory

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