

Sensor technology used in researcher's study identified brain activity in colleague's comatose wife

April 8 2015, by Ken Branson



Melissa Carleton Lande before the seizure that put her in a coma. Credit: Brian Lande

A frantic phone call to Rutgers neuroscientist Liz Torres from a

colleague whose pregnant wife had slipped into a coma has led to the use of sensors that can detect visually imperceptible motions in a comatose person, proving she had some awareness, that she was struggling to communicate, and that her condition was slowly improving.

Elizabeth Torres and her colleague, Brian Lande, have published their research in *Frontiers in Human Neuroscience*. Their research, based on the case of Lande's wife, Melissa Carleton, offers a window into severe brain trauma and could provide doctors with a better understanding of a patient's brain activity.

"Our main discovery is that, in human motions, noise is a signal," Torres says. "Physicians observe a comatose person moving, and the motions seem random to them – noise, in other words. But with the use of these sensors, we see tiny motions that are imperceptible to the naked eye, and those motions contain important information that gives us insight into the brain's capacity to control the body."

The paper comes a year after Torres, an assistant professor of psychology in the School of Arts and Sciences, got a call from Lande, a research associate in computer science at the University of California-Santa Cruz, with terrible news and a desperate request.

"I was giving a talk in California, and just as I was about to give the talk, he (Lande) called and told me his wife, who was seven months pregnant, had brain cancer, had had a seizure and gone into a coma, and he wanted to know if I knew of any way to know if she was still there," Torres recalls.

Torres met Lande in 2012, when she gave a talk about her autism research to the Defense Advanced Research Projects Agency, where Lande was then a program manager. Their research interests were similar: using sensor technology to understand how the brain, body and

outside world interact. When she finished her talk in California, another researcher who studies the neuromotor development of babies showed Torres a wearable, synchronized pair of sensors she used in her work. Torres emailed Lande a photo of the sensor and told him that she might be able to help if he could attach the sensors to his wife and send the data to her lab at Rutgers.



West Lande, 10 months old, with his mother, Melissa. Credit: Brian Lande

Lande lost no time. To her doctors, his wife didn't seem to be improving

at all, and they were starting to cut down on her therapy as a result. They thought she might be in a [persistent vegetative state](#) and had hinted that a long-term care facility might be best. But Lande and his family thought Melissa, who was receiving physical therapy, had shown small improvements.

"It was terrifying," Lande says. "Imagine someone you love, having some kind of signs of life, like raising her thumb when you take her hand, and they are ready to write her off because they weren't there and they don't find you credible."

Lande was able to procure the sensors from an Oregon-based company, APDM. He placed them on Melissa's wrists, and the sensors recorded the motions Melissa made with her arms as well as her skin surface temperature and the ambient temperature. Every day for four months, Lande downloaded the data from the sensors to his computer and sent the file to Torres, who looked for patterns using her unique algorithms.

Torres immediately noticed a pattern in Melissa's movements – enough to tell her that Melissa was aware and intentional in her movements.

In May, Torres saw a flurry of unusual activity generated from Melissa's right arm. "I called Brian and asked what had happened," she recalls. "He told me, 'My son was born.'"

Lande told Torres that Melissa had been rubbing her abdomen until shortly before her son, West, was delivered by C-section.

That settled the matter for Torres. Melissa was still Melissa; she understood much of what was happening around her.

Today, Melissa Carlton Lande is out of her coma and at home, undergoing intense physical and speech therapy. The seizure has left her

profoundly disabled. She is working hard to get her speech back, can move her arms but has trouble gripping with her hands. But she's still Melissa. She knows her husband, her parents and 10-month-old West. She has figured out ways to communicate with them about her needs.

"Yesterday, she said 'I love you' to West for the first time," Lande says. "Her mother and I were there, and her mother was holding West and telling him, 'Tell Mama I love you,' and Melissa suddenly said, 'I love you.'"

Lande has no idea how close Melissa can come to where she was before her illness. But he's encouraged by how far she has come. "She has persisted in surprising me," he says.

More information: "Objective and personalized longitudinal assessment of a pregnant patient with post severe brain trauma." *Front. Hum. Neurosci.*, 17 March 2015 | [DOI: 10.3389/fnhum.2015.00128](https://doi.org/10.3389/fnhum.2015.00128)

Provided by Rutgers University

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