

## Research Into Behavioral Markers Of Disease

Intel

Oregon Health

Oregon Health & Science University



That's because her house is outfitted with tiny sensors that track her movements and behavior, as part of a special research project jointly conducted by the Oregon Health and Science University (OHSU) and Intel.

Graves, who is 77, is optimistic that the data gathered from the study will contribute to greater understanding of diseases and health issues affecting the elderly.

"If not me, it should help the baby boomers down the road," quips Graves, who says she has the spirit of a 45-year-old. "And I have grandchildren and a great grandchild who I believe will benefit, too. But in any case, helping science is a good thing to do."

Graves has been involved since early 2007 in this longitudinal research effort coordinated by the OHSU's interdisciplinary Oregon Center for Aging & Technology (ORCATECH), which is directed by OHSU neurologist

Dr. Jeffrey Kaye. ORCATECH has been supported since 2004 by federal agencies, including the National Institutes of Health and the National Institute on Aging.

In October 2006, Intel's Digital Health Group signed a three-year, \$3 million collaboration agreement with OHSU called the Behavioral Assessment and Intervention Commons (BAIC). The alliance with OHSU is designed to initiate and accelerate research into behavioral markers of disease, such as changes in walking and performance on computer games. The research should eventually translate into health-related products, services and personalized medicine.

The collaboration between Intel and the university is unique because Intel recognizes the value of a university research partner. "We are inquiry driven, not product-driven, and we need to publish our research. Intel not only understands that but they value it," says Kristin Rencher, a licensing associate in the Office of Technology and Research Collaborations at OHSU. "They are keen to see us publish and recognize the power of scientific publications in enabling the adoption process of health technologies."

Arundee Pradhan, director of the Office of Technology and Research Collaborations at OHSU praises the BAIC and says it "represents an emerging model for creating university-industry collaborations in the appropriate context."

"Because of the size of the market we expect that the collaboration will result in products, but that is not the focus. We didn't walk into negotiations with the expectation of royalties," he says. "For us the bottom line is creating a partnership that furthers the research."

### **Signing up her Friends**

Graves notes proudly that she was the third or fourth person to enroll in the BAIC project.

"I thought it was such an admirable thing that I got several of my friends to sign up too," adds Graves, who is a semi-retired communications coach. As part of the project, OHSU and Intel researchers placed dozens of sensors around Graves' home to track her daily movements around the clock. The resulting data will provide hints of changes in the heart and lung diseases from which she suffers or, detect early indications of Alzheimer's disease, should they arise.

"These sensors are throughout the house," she says. "On the doors, along the walls and attached to my refrigerator. I even have a special pillbox that pays attention to when I take my vitamins."

In addition, she wears a belt one week a month that monitors her physical movements. She also has a cell phone with a global positioning system to track her whereabouts when she leaves her home.

On Monday mornings, Graves gets an automated call to remind her to take a memory test on a computer provided by Intel. In addition to the quiz, she is asked questions about her health status, including if she has fallen, changed her medicines or even if she has moved her furniture — the latter being important because it could affect how the sensors function.

"They say they are trying not to overwhelm me with too much technology, but I find this sort of stuff fascinating" she says. "How they think up and implement all these things is beyond me."

Tamara Hayes, assistant professor of biomedical engineering at the OHSU School of Science and Engineering and the BAIC project's lead investigator, says BAIC is a complement to the university's National Institutes of Health based studies of age-related health outcomes.

"It will allow us to make significant progress in developing continuous assessment and in-home technologies that have

clinical relevance,” she says. “The initial living lab of homes that were funded in 2005 allowed us to test out technologies and make sure we were ready to go forward with Intel and BAIC.”

She said Intel chose OHSU because it is “able to deliver critical information for the development of truly useful independent living technology. They could come up with products and solutions that they think will work. But with no way to test them on patients there is no guarantee they will hit the mark.”

“*In addition to the core set of sensors, she said some participants wear radio frequency identification (RFID) tags, so the monitors will know who is moving about the house when guests are in the home.*”

Other components include coaching and intervention to encourage individuals to take their medications. “Right now, we are creating algorithms based on our data that will tell us the right time to prompt patients to take their medications,” she says.

And there are also games to keep their minds alert and to be used as ongoing assessment tools by recording changes in how well the seniors score when playing the games.

Hayes said it has been remarkably easy to get people to sign up for the program. “They realize this is a good project and they want to help,” she says.

### **A Marriage of Research Interests Benefiting the Elderly**

The way Eric Dishman, general manager of product research and incubation at Intel’s Digital Health Group, remembers it, the collaboration with OHSU began about seven years ago. That was shortly after he was hired.

“This was before there was a Digital Health Group here and before ORCATECH existed,” he said.

But over time, the two entities moved from what Dishman calls “dating to full-on marriage,” an arrangement that was more or less consummated with the \$3 million BAIC grant.

Back in 2002, before the nuptials, Intel’s Research Council awarded ORCATECH investigator Misha Pavel, an OHSU professor of biomedical engineering, a small seed grant to get things off the ground.

Pavel directs ORCATECH’s Point of Care Lab, where many of these devices are developed and tested prior to their deployment in homes. He says refining devices such as games will help seniors maintain their cognitive abilities, much as physical exercise helps to maintain physical condition.

Dishman notes that while the studies are focused on seniors, other populations can benefit from the research.

“I get about 500 phone calls a month from families with autistic children who have seen prototypes from the research that we have done on people with Alzheimer’s,” he says. “And they say they need these same kinds of capabilities.”

Dishman said the market potential for products to aid independent living is huge and growing fast.

“There are 600 million people on this earth who are over the age of 65 today,” he says. “That will double to 1.2 billion by 2025, then double again in the next 20 years, so there is an enormous market opportunity because many people who are 65 and older have multiple chronic conditions.

“And the 80-year-old plus category is the fastest-growing worldwide. Sadly, half of all 80 -year-olds will have some

type of dementia by the time they are 85. There is an enormous potential for a home health platform that would better allow people to manage their own health and welfare as well as provide early warning systems through looking at behavioral and biological changes. It's a market worth potentially hundreds of billions of dollars."

But before any products can be sold, he says the underlying technologies need to be put through large-scale, longitudinal studies.

"The whole ORCATECH thing is about how we bring scale to this effort," he says. "We can't just test in dozens of households. We are testing in hundreds and then thousands of homes so we can look at statistical trends of both large populations and individuals.

"This effort will bring scientific rigor to the field of behavioral biomarkers. Genetic biomarkers show we might be biologically at risk for a condition. Behavioral biomarkers are ways of measuring and monitoring behavior using technology to show the early detection or onset of a disease."

Dishman says the BAIC program will increase national attention around behavioral biomarkers, not just their medical counterparts. "You combine the two and you can start to do some pretty powerful stuff," he says.

"If you have a genetic biomarker that says you are at risk for Alzheimer's and you combine it with behavioral biomarkers that look for subtle changes of everything from how you talk to how you walk, then you start to have a much better early warning system and even the ability to intervene before the disease unfolds fully."

*Better World Report, Part 1, 2008*

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