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## OU Researcher's Idea-Turned-Invention Showcased at Smithsonian This Week

*Robotic device designed to help babies with disabilities make physical and developmental gains*

A University of Oklahoma researcher dreamed of a device to help babies with disabilities crawl. Now, that dream is a reality and one of only 13 inventions to be showcased this weekend at the Smithsonian in Washington D.C.

It's an innovation like no other. The Self-Initiated Prone Powered Crawler, the brainchild of researcher Thubi Kolobi, Ph.D. of the OU Health Sciences Center, was given robotic life by a colleague at Virginia Commonwealth University and computer scientists as well as engineers on OU's Norman campus.

Commonly known by its acronym SIPPC ("sip-see"), the device marries technology with a baby's innate desire to move and explore his or her environment. It listens to subtle cues from babies with cerebral palsy and other disabilities, allowing them movement that would not be possible otherwise.

"The SIPPC is not just an instrument. It is an interactive device with movement initiated by the baby. It is the baby and the device working together that make the SIPPC system. This makes it not only innovative, but one of a kind," said Thubi Kolobe, Ph.D., Jill Pitman Jones Professor of Physical Therapy in the OU College of Allied Health's Department of Rehabilitation Sciences.

OU's Office of Technology Development, working with VCU, has secured a jointly-held patent on the second iteration of the SIPPC, also called SIPPC 2.

In the eantime, computer scientists and engineers at OU Norman work to advance the next generation of the device − one that is even more responsive to the baby's movements and that provides important new insights into brain function of babies while utilizing the SIPPC.

"The selection of this device to be a part of this important national event honors the dedication of OU researchers to help improve the lives of children at risk for disabilities and those living with them, " said David L. Boren, president, the University of Oklahoma. "It also underlines the importance of the patent and intellectual property systems in supporting both invention and innovation, as we work to move new devices and treatments more quickly to those who need them."

The public will get hands-on exposure to the SIPPC 2 at the Smithsonian's Innovation Festival this weekend, Sept. 26 and 27, in Washington D.C.

"We are very proud of this research," said Dr. Jason Sanders, interim senior vice president and provost of the OU Health Sciences Center. "Innovation is a big part of America's story. This Smithsonian event provides a unique opportunity for the public to discover inventions and to meet those, like Dr. Kolobe, whose dreams and designs have created new innovations that ultimately may change or enhance lives."

**The SIPPC – Past, Present and Future**

It was Kolobe's early research with babies born prematurely that gave birth to the idea of a device that could harness early movement displayed by infants at risk for cerebral palsy and help them make physical and developmental gains that might be missed otherwise.

"I noticed that these babies in the neonatal intensive care unit would move a little bit. They kicked, moved and kicked. As the babies with cerebral palsy got older they started to show less and less movement. So the idea was to find a way to harness the movements that these babies were making very early on and reward those because babies only gain additional movement when they are successful."

Kolobe took her initial sketch to a colleague at VCU, Peter Pidcoe, Ph.D., a fellow physical therapist and bio-engineer who also dabbled in robotics. Pidcoe in collaboration with computer scientists and engineers at OU brought Kolobe's idea to life.

"The shape is contoured so that the babies rest in the center with their trunk and then there are straps that go around that hold them in place. What's underneath the box is the brain of the device. Any subtle positional change causes it to turn on and help them with that movement," Pidcoe said.

Dr. Kolobe and her team at OU tested the device with babies in Oklahoma, which provided the information needed to fine tune the SIPPC.

"Remember, babies don't go in the direction you want them to go. So we had to observe babies to see how they moved to the right, and to the left, to make sure that the device responded to that and also to determine how much of an assist each baby might need," Kolobe explained.

Kolobe is now working with a team of engineers at the Gallogly College of Engineering at OU's Norman campus on further enhancements to the SIPPC to aid both the babies in movement and also research data collection

A high tech "onesie" equipped with 12 sensors and worn by the baby on the SIPPC captures information 50 times a second.

"The SIPPC suit allows us to capture even the tiniest movements made by the babies and help reward those with robotic movement," said Andrew Fagg, Ph.D., associate professor of Computer Science and Bioengineering.

David Miller, Ph.D., Wilkonson Chair of Intelligent Systems and professor of Aerospace and Mechanical Engineering at OU, led the design and fabrication of a new SIPPC 3 robot. It includes several innovative capabilities. One of those is its ability to adjust the baby's distance to the ground in real time.

"In previous versions, the infant was relatively high off the ground. The new SIPPC 3 design allows for the baby's distance to the ground to be adjusted in real time to match the baby's size and level of crawling development," Miller said.

The SIPPC 3 also provides additional options for movement. Miller said any point of rotation and any direction of movement are now possible.

Perhaps most importantly, the new design includes a way to capture critical information about how the device may aid learning and development. That's because the SIPPC 3 also now includes a sensor cap worn on the baby's head.

"The cap is essentially a net with dozens of sensors that utilizes electroencephalographic or EEG monitoring to record the brainwaves of the baby while utilizing the SIPPC," said Lei Ding, Ph.D., Lloyd and Joyce Austin Presidential Professor, OU School of Electrical and Computer Engineering.

The hope is that with the SIPPC's help, babies will gain the movement needed to explore their worlds, helping forge important pathways in the brain, perhaps triggering new abilities in infants born with disability.

"It took a while for them (the twins) to do it. Then it clicked and they started moving around like crazy. I think it's amazing – the things, the movements they can track," said Samonia Byford, whose twins took part in the OU clinical trial.

Byford's twins were born prematurely and at risk for cerebral palsy. She was grateful to learn that both children do not have cerebral palsy, but hopes the information her babies are providing through their participation in the research may help other babies and families who are faced with that difficult diagnosis.

For scientists and engineers accustomed to looking at numbers and designs, there is a unique sense of fulfillment in this work.

"The most rewarding aspect of this work is just seeing the look on otherwise immobile infants' faces when they are able to move towards an object they want. That's great," Miller said.

Kolobe now dreams of the day when all of the modifications have been done and when sufficient evidence exists to move the SIPPC from clinical trials into regular use, perhaps in the form of a streamlined, ultra-portable design that parents will be able to utilize themselves with their babies at home.

"As scientists, we are really careful about introducing devices to the public and only do so when there is evidence of their effectiveness. So that's going to take a little bit of time," Kolobe said.

Time and more research, she added. The next step is a clinical trial comparing babies who have used the SIPPC to those who have not.

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