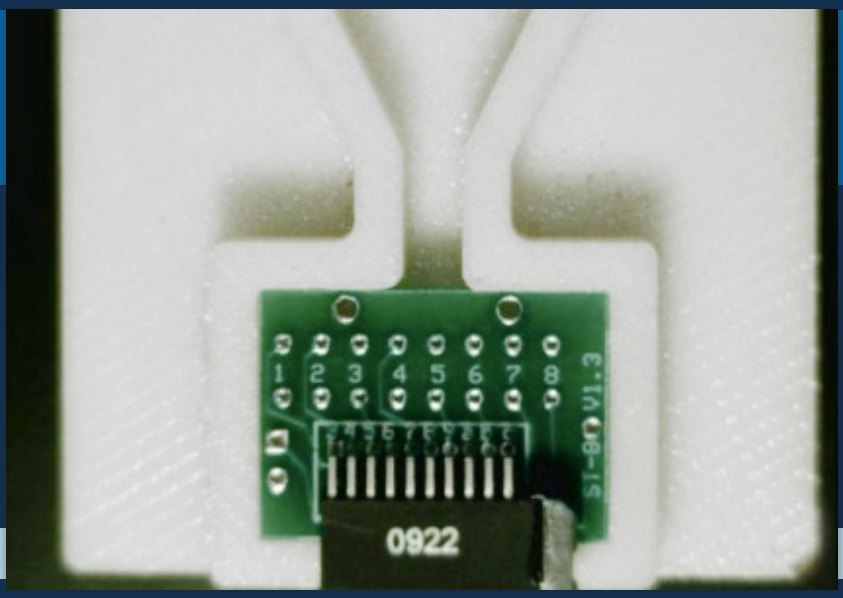
APPLICATION STORY



UT Dallas Professor Uses 3D Printer to Help Treat Aftereffects of Strokes

The Dimension 3D Printer has accelerated this important research by a factor of four or five, and it gives me the freedom to think outside the box. I am not constrained to incremental steps. I can design an entirely new device and print it in a single day."

— Dr. Robert Rennaker II
Associate Professor,
University of Texas-Dallas

For decades, researchers have been looking for ways to manipulate the brain in order to determine how it changes as it learns or comes under the influence of drugs and other stimuli. Understanding how these influencers affect brain activity can lead to treatment of stroke aftereffects, such as loss of muscle control and aphasia (the loss of ability to talk, listen, read and write).

Dr. Robert Rennaker II, an Associate Professor at the Erik Jonsson School of Engineering and the School of Behavioral and Brain Sciences at the University of Texas at Dallas, is one such researcher who has been investigating this area of neuroscience for years.

In 2009, Dr. Rennaker received a research grant from the National Institute on Deafness and Other Communication Disorders (NIDCD) to study olfactory encoding of odorants (how the brain processes smells). His other research interests including auditory neuroscience and plasticity (the way entire brain structures can change to better cope with the environment; specifically, when an area of the brain is damaged and non-functional, another area may take over some of the function).

His work is now focused on investigating the development of treatments for neurological conditions such as strokes. Interestingly, one of the most important tools in support of his research efforts is the application of 3D printing in his laboratory.

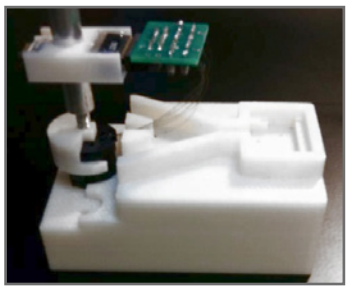
The Missing Piece

Rennaker needed to produce parts strong enough for lab testing, durable enough to assemble and absorb load impacts, and detailed enough to develop brain-machine interfaces to study how the brain responds to different stimuli. However, sending CAD files to a machine shop to manufacture these parts meant waiting weeks to receive the printed models and created extended research delays.

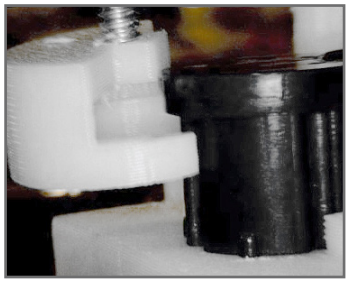
"Under the old machine shop fabrication system, one miniscule change would cost us innumerable time and significant expense. It was essentially impossible to conduct this type of research," Rennaker said.

Brain Research Made Smarter with 3D

The inability to build prototypes for research equipment led Rennaker's biomedical engineering department to purchase the Dimension 1200ES SST Elite model printer in June 2009. Rennaker found the Dimension 3D Printer through an online search and although he considered a competitor, he found the superior strength of the ABS plastic used by the Dimension printer necessary to satisfy the needs of his research projects.



"He builds much of his equipment himself with the Dimension 3D Printer and a laser engraver. The pieces house electrode cases, which sit on the head of mice," said Adam McKinnerney of Teaching Systems. "He also builds their testing station with the printer. The applications he's developed are really amazing."



With the printer, he is now able to use the same subject for an extended period of time, which is safer for the subjects and yields better, more accurate results. Rennaker also uses the Dimension printer to build behavioral cages, electrode manufacturing stands and pokes (which help reinforce behavior) - and not just prototypes. He can actually build the end-use parts because the 3D printed parts are so strong.

3D Speeds Important Research That Impacts Stroke Victims

Rennaker is currently working on a stroke project dealing with loss of motor functions in the motor cortex (the part of the brain that plans, controls and executes voluntary motor functions). Post-stroke, a patient often loses the ability to move a hand. Rennaker uses his research to simulate this disability with his lab subjects. The subjects place a paw in a hole with a wheel at the bottom, when the subjects rotate the wheel they are given a food reward. The device forces the subject to use its paw instead of its whole leg. The group is studying the effect of stimulating the Vagus nerve while performing the task in an attempt to facilitate and expedite recovery of function in the limb affected by the stroke.

The researchers hope that someday this patented Vagus Nerve Stimulation (VNS) technique will help human stroke victims recover faster and more fully. Rennaker's 3D printers have been essential to the progress of this research project. "The Dimension 3D Printer has accelerated this important research by a factor of four or five, and it gives me the freedom to think outside the box. I am not constrained to incremental steps," says Rennaker. "I can design an entirely new device and print it in a single day."

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