

Alumni Highlight

ALL IN YOUR HEAD: BME ALUM CARRIES BRAIN WORK TO PRESIDENTIAL LEVEL

When Justin Sanchez completed his doctoral work in 2004 from the J. Crayton Pruitt Family Department of Biomedical Engineering, he was only the second Ph.D. student to graduate from the young department, formalized just two years before.

Carrying the Tampa native into the field were two goals he'd had since childhood: to work in science and technology, and to help people. These were perhaps lofty, cliché goals for a youngster, but Dr. Sanchez, now 37, has fulfilled them in many ways in his work in neuroprosthetics, the discipline that uses electronic machinery to help in functions that might have been lost from brain injury or illness.

In fact, he sees his present position in the Defense Advanced Research Projects Agency (DARPA) in Arlington, Virginia — part of the Department of Defense — as “a unique opportunity” that goes as far as to ask, “How do we change the world?”

“The best you can do right now is go talk to your therapist on the couch or take medications, and we want to do much better than that,” he says of those with brain injuries, neuropsychiatric issues, and who have trouble with memories and moving.

“We want to develop technologies that are based on knowledge of how the brain functions and use that knowledge to deliver precise therapy back to the brain.”

Sanchez was hired by DARPA in June 2013 following biomedical engineering professorships at the University of Florida and the University of Miami. Traditionally, DARPA's focus is developing technology for military use.

Sanchez's work would help current and former soldiers who may have neuropsychiatric illnesses, such as depression, PTSD and anxiety. But it also stands to assist anyone with brain disorders by being tied to President Obama's BRAIN Initiative, launched in April 2013.

The \$300 million effort brings together DARPA, the National Institutes of Health, the National Science Foundation and other organizations to improve the understanding of how the brain works, the disorders that affect it, and technologies that can unlock mysteries within.

As a DARPA project manager, Sanchez is meant to find out what research aspects the U.S. needs to invest in to stay ahead of the rest of the world, or to at least not be bewildered when another country makes a discovery.

“We have this slogan here that says, ‘DARPA: Create, or prevent technological surprise,’” Sanchez says.

This objective dates back to the founding of DARPA in 1958 as a response to Russia's launch of the first human-made satellite, Sputnik, the year before.



Above: Defense Secretary Chuck Hagel, left, examines a prototype prosthetic arm and hand developed by DARPA, fitted to Fred Downs, right, and explained by Justin Sanchez, center, a program manager with DARPA

With his neuroprosthetic focus, Sanchez oversees multiple programs that have different aims but fall in line with the BRAIN Initiative's goals. The programs include Enabling Stress Resistance; Neuro Function, Activity, Structure, and Technology; Restoring Active Memory; and Revolutionizing Prosthetics.

Working on these projects are multidisciplinary teams of several hundred researchers with specialties in software, hardware, the brain and other related fields. The follow up, Sanchez says, could be going to a medical-device manufacturer in the private industry to bring any technologies developed to the commercial market.

Sanchez's curriculum vitae is an expansive one, going far beyond DARPA. Among his accolades: being credited to 75-plus academic papers, co-authoring the 2007 book *Brain-Machine Interface Engineering*, and holding seven patents in neuroprosthetic design.

His advice to current BME students: “Define your own future.” When he started graduate courses related to biomedical engineering at UF, the department was not yet official, but he knew he wanted to work in neuroprosthetics. So he sought out faculty and mentorship that would further his goal.

One such mentor was Dr. Michael Okun, now interim chair of UF's Department of Neurology

and co-director of the Center for Movement Disorders and Neurorestoration. Okun says that when he began working at UF in the early 2000s, Sanchez was one of his first students.

In the lab, they explored the physiology of human brain cells and how different regions of the brain talk with one another.

Okun says it's “very gratifying to see someone like that go all the way up to one of the top positions at DARPA.”

“Justin was always a cut above,” he adds. “He was running with the cream of the crop. He was thinking like a scientist, even as an undergraduate.”

Continuing with his advice for future students, Sanchez says being a “go-getter kind of a student is the best thing you can do.”

“I would always tell any person who is in the BME program that there are bound to be new fields in biomedical engineering that are going to be emerging, that are not well established,” Sanchez says.

“I know a lot of students now look to the program to tell them what they should be doing. And I guess the message that I'm saying is the reverse of that: The students should have the desire to seek out new knowledge and new technologies.”

BY MICHAEL STONE