

# Uncovering How the Brain Works



**Gabriel Silva**

Professor and Vice Chair, Department of Bioengineering, Professor, Department of Ophthalmology and Neurosciences Program

## CURRENT RESEARCH

### Studying the biological brain for the purpose of engineering

The human brain is one of the most impressively designed biological systems. The ideas of conscience, self-awareness, and learning in unique ways are novel to our brain, and have been enviously studied by designers of engineered systems. Dr. Gabriel Silva, Professor and Vice Chair of the Department of Bioengineering at the University of California, San Diego, is pushing the boundaries of our understanding of the brain and how it works by developing algorithms and models that explain its function mathematically. In order to understand how the brain works normally, and what fails in disease states, within a dynamic system that is constantly changing, like the brain, mathematics and experimental data must be used. Dr. Silva is taking fundamental mathematical data to design models that explain how the brain works and processes information. The models allow Dr. Silva to understand the brain as a complex system, and to make predictions about how it works normally and fails in disease. Further, if he is able to understand the algorithms that govern how the brain represents, processes, and computes information, he may be able to apply them to neuromimetic engineered systems and computational architecture with no relation to the biological brain. This would allow the incorporation of properties unique to the human brain into artificial systems, including robustness, our ability to learn and be trained on a small data set, the ability to adapt and learn beyond that small data set, autonomy - or our ability to make decisions on our own, the ability to carry out high-level computations at physically low power requirements, and real-time adaptability - the ability of an algorithm to change its own governing rules to improve...

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## AFFILIATION

 University of California, San Diego

## EDUCATION

- Postdoctoral Fellowship, in Institute for BioNanotechnology in Medicine (IBNAM) and Department of Neurology, 2003, Northwestern University
- Ph.D., in Department of Bioengineering and Department of Ophthalmology, 2001, University of Illinois at Chicago
- M.Sc., in Department of Physiology and Graduate Program in Neuroscience, 1998, University of Toronto
- Hon. B.Sc., in Human Physiology, 1996, B.Sc., in Biophysics, 1996, University of Toronto

## AWARDS

- Career Milestone Award, 2014
- Biocom Cell Art Exhibit winning entry: "SEM of cortical neurons on optoelectronics nanowires," 2014
- 'Faculty of the Year' award for undergraduate education, 2012
- Jacobs Faculty Fellows Chair in Bioengineering, 2009-2014
- Selection to "Nanoscience: The best of NATURE publications," 2009
- and 2 more...

## RESEARCH AREAS

Technology, Computational Sciences / Mathematics, Materials Science / Physics, Nanotechnology

## FUNDING REQUEST

Your contributions will allow Dr. Silva to acquire the necessary resources for executing his research projects. Need is project specific, but overall student resources play a key role in performing this research, as do physical resources. Dr. Silva's lab builds their own GPU (graphics processing unit) servers for simulations, which require hardware and software components. Benefunder funding will allow the brain to be explored at a mathematical level for contribution to engineered systems.