Curriculum Vitae

Date: January 1, 2026

PERSONAL

Name: Justin C. Sanchez, Ph.D.

Current Position: Tech Fellow, Battelle

Citizenship: US Citizen

Expertise: Senior Executive leadership to deliver transformative teams, technology, and partnerships in government, industry, and academia.

Web: https://jcsanchez.com

SHORT BIO

Justin C. Sanchez, PhD is a Battelle Technical Fellow. As a noted expert in biotechnology, he creates strategic vision to guide Battelle's life sciences and biotechnology businesses. Serving on the executive leadership team, Dr. Sanchez leads the organization's technical investment strategies and initiates and drives collaboration across Battelle, as well as with government, industry, and academia partners resulting in hundreds of new proposals and projects with whole of government federal agencies and commercial partners. Working in the fields of health, national security, and environment/infrastructure, Dr. Sanchez has led technical and business teams to perform advanced development of notable breakthroughs in neurotechnology, gene editing/synthetic biology, quantum, nuclear, and chemical remediation in the full life cycle of idea generation, IP protection, and commercialization. Beyond advanced development, Dr. Sanchez has established an institute for neurotechnology (in partnership with The Ohio State University) and a national conference on innovations in resilience (in partnership with the National Labs). During his time at Battelle, Dr. Sanchez has driven national efforts in the establishment of a DOD microelectronics hub, HHS investor catalyst hub, and COVID testing for K-12 students.

Prior to joining Battelle, Dr. Sanchez was the Director of the Biological Technologies Office (BTO) at DARPA. He advanced the mission of BTO through strategy development focused on vital breakthrough technologies and capabilities for national security, particularly in the areas of neurotechnology, gene editing/synthetic biology, and infectious disease. Major accomplishments include developing foundational human neurotechnology for the United States BRAIN Initiative, delivering the world's most advanced prosthetic arm to military Veterans, accelerating gene editing techniques for national security/human health, and forming partnerships to deliver countermeasures in the African Ebola crisis. He was responsible for starting 31 new DARPA programs and investing more than $1.65 billion at national labs, industry, and academic institutions.

Prior to joining DARPA, he was an associate professor of Biomedical Engineering and Neuroscience at the University of Miami. He directed the Neuroprosthetics Research Group where he oversaw development of neural-interface medical treatments. He has published more than 100 peer-reviewed papers, eight patents, and two books on the design of neurotechnology.

Dr. Sanchez holds a Doctor of Philosophy and Master of Engineering degrees in Biomedical Engineering, and a Bachelor of Science degree in Engineering Science, all from the University of Florida.

HIGHER EDUCATION

Institutional (institution; degree; date conferred):

- University of Florida, Doctor of Philosophy in Biomedical Engineering, 2004
- University of Florida, Master of Engineering in Biomedical Engineering, 2004
- University of Florida, Bachelor of Science in Engineering Science (minor Biomechanics), 2000

EXPERIENCE

- Interim CEO, NeuroTech Institute, 2024-present
- Battelle Memorial Institute, Technical Fellow, 2019-present
- Defense Advanced Research Projects Agency (DARPA), Director (Biological Technologies Office), 2016-2019
- Defense Advanced Research Projects Agency (DARPA), Acting Deputy Director (Biological Technologies Office), 2015-2016
- Defense Advanced Research Projects Agency (DARPA), Program Manager (Biological Technologies Office), 2014-2015
- Defense Advanced Research Projects Agency (DARPA), Program Manager (Defense Sciences Office), 2013-2014
- University of Miami, Associate Professor of Neuroscience, 2011-2016
- University of Miami, Associate Professor of Biomedical Engineering, 2010-2016
- University of Miami, Faculty Member Miami Project to Cure Paralysis, 2010-2016
- University of Florida, Affiliate Assistant Professor of Biomedical Engineering, 2006-2010
- University of Florida, Affiliate Assistant Professor of Neuroscience, 2005-2010
- University of Florida, Assistant Professor of Pediatrics (Neurology), 2005-2010
- University of Florida, Research Assistant Professor of Pediatrics (Neurology), 2004-2005
- University of Florida, Research Assistant, 2000-2004

Battelle Leadership and Experience:

- Senior executive leadership in a $11B business and 3000+ person organization
- Strategic technology and business development in three business units: Health, National Security, Environment & Infrastructure
- Guide commercial and government client engagement in key life science businesses
- Conceive, launch, and manage government and commercial research and development projects of scale ranging from $10-200MM
- Intellectual property development and management including licensing and royalty deals
- Guidance and management of internal research and development investment
- Personnel recruiting and leadership/professional development of individuals and teams
- Design and launch of spinout commercial business opportunities in the life sciences
- Lead high-priority initiatives in global climate resilience (view site)
- Lead the solutioning for new government infrastructure Hub awards in health and microelectronics
- Develop philanthropic programs for military veterans and STEM education

DARPA Leadership and Programs:

While serving at DARPA, Dr. Sanchez developed the office's international strategy for biotechnology. He recruited program managers and assembled and lead a high-performance team to deliver breakthrough capabilities

for the United States of America. Below are programs that Dr. Sanchez provided conceptualization, guidance, evaluation, and financial support while serving as BTO Director. The programs were defended annually before Congress and were briefed to all levels of leadership in the Pentagon and White House. Through the course of their operation, the programs interfaced across the Interagency (health, regulatory, intelligence, and security organizations). Program transition involved small and large businesses, venture, foundations, and all branches of the DoD.

- Advanced Plant Technologies (APT)
- Autonomous Diagnostics to Enable Prevention and Therapeutics (ADEPT)
- Battlefield Medicine
- Biological Control
- Biological Robustness in Complex Settings (BRICS)
- Biostasis
- Electrical Prescriptions (ElectRx)
- Engineered Living Materials (ELM)
- ECHO
- Friend or Foe
- Hand Proprioception and Touch Interfaces (HAPTIX)
- Insect Allies
- INTERfering and Co-Evolving Prevention and Therapy (INTERCEPT)
- Living Foundries
- Maritime Materials Technology (M2T)
- Microphysiological Systems (MPS)
- Neural Engineering System Design (NESD)
- Neuro Function, Activity, Structure, and Technology (Neuro-FAST)
- Next-Generation Nonsurgical Neurotechnology (N^3)
- Panacea
- Pandemic Prevention Platform (P3)
- Pathogen Predators
- Persistent Aquatic Living Sensors (PALS)
- PReemptive Expression of Protective Alleles and Response Elements (PREPARE)
- PREventing EMerging Pathogenic Threats (PREEMPT)
- Prometheus
- Rapid Threat Assessment
- Restoring Active Memory (RAM)
- ReVector
- Revolutionizing Prosthetics
- Safe Genes
- Systems-Based Neurotechnology for Emerging Therapies (SUBNETS)
- Targeted Neuroplasticity Training (TNT)
- Technologies for Host Resilience (THorR)

HONORS AND AWARDS

2017	Service to America Medal Finalist (view article)
2015	Foreign Policy 2015 Global Thinker (view article)
2012	Johnson A. Edosomwan Researcher of the Year Award

2011	Eliahu I. Jury Early Career Research Award
2005	American Epilepsy Society Young Investigator Award
2005	IEEE Excellence in Neural Engineering Award

PROFESSIONAL WORK AND ACTIVITIES

80. Defense Opinion - Time to Redefine Biosecurity as a High-Impact Strategic Necessity, 2025 (view article)

79. National Academy of Sciences - "Developing Robust Commercialization Pathways for Emerging Technologies in AI and HPC," 2025 (view article)

78. Singapore International Energy Week - "Nuclear Cooperation Agreement Signed with Battelle Memorial Institute," 2025 (view article)

77. Wall Street Journal - Coming to a Brain Near You: A Tiny Computer, 2025 (view article)

76. Wired - A Neuralink Rival Just Tested a Brain Implant in a Person, 2025 (view article)

75. Beyond the Digital Horizon: Embracing the Physical World in the Age of AI, 2024 (view article)

74. Federation of American Scientists (new Policy Memo) – BioNETWORK: The Internet of Distributed Biomanufacturing, 2023 (view article)

73. Politico – What will it take to prevent the next pandemic?, 2021 (view article)

72. Fierce Biotech – Separating science from sci-fi: Battelle's Justin Sanchez on balancing the buzz of brain-computer interfaces, 2021 (view article)

71. Neural Implant Podcast – Justin Sanchez on going from working at DARPA to helping roll out tech at Battelle, 2021 (view article)

70. Gen –The COVID-19 Pandemic: Lessons for the Future, 2021 (view article)

69. NHK Japan – Uses of Brain-Machine Interface Technology, 2021 (view article)

68. Inside Battelle – NeuroLife® Sleeve Holds Promise of Improved Sports Performance, 2020 (view article)

67. Bulletin of Atomic Scientists – The Brain-Computer Interface is Coming and We are so Not Ready for It, 2020 (view article)

66. Ohio Magazine – 3 Questions: Justin Sanchez, 2020 (view article)

65. ZDNet – If we put computers in our brains, strange things might happen to our minds, 2020 (view article)

64. FOX32 Chicago – Illinois using decontamination system that can clean thousands of N95 masks in

24 hours, 2020 (view article)

63. NBC News – A dinner table chat between husband and wife may help solve the coronavirus mask shortage, 2020 (view article)

62. NBC5 Washington – Nurses demand better protective gear as new mask sterilization system arrives in Washington, 2020 (view article)

61. ABC5 Cleveland – Battelle Memorial Institute partners with OSU to create rapid results testing for COVID-19, 2020 (view article)

60. Consumer Electronic Showcase (CES) – Neurotechology - Digital Health Summit, 2020 (view article)

59. Inside Battelle – How do you want to connect with your brain today?, 2020 (view article)

58. Defense One – The US Army Is Making Synthetic Biology a Priority, 2019 (view article)

57. Breaking Defense – Biotech: Can Microscopic Sentries Protect US Troops?, 2019 (view article)

56. The Atlantic – Can we Extend Human Lifespans to 150?, 2018 (view article)

55. Defense One – It's Now Possible to Telepathically Communicate with a Drone Swarm, 2018 (view article)

54. New Yorker – Degrees of Freedom, 2018 (view article)

53. DARPA 60th Magazine – Security and Surprise at Biological Scales, 2018 (view article) page 102

52. Not Impossible – The Arm Race, 2018 (view article)

51. Wall Street Journal – The Key to Smarter AI: Copy the Brain, 2018 (view article)

50. NPR – A Tiny Pulse of Electricity can Help the Brain form Lasting Memories, 2018 (view article)

49. Gizmodo – DARPA Exec Warns Biohackers to Think Deeply about Injecting Untested Treatments, 2018 (view article)

48. Future of Storytelling – Neurotechnology and Storytelling, 2017 (view article)

47. Occupational Health & Safety – DARPA Meeting Looks at Biotech's Promise, 2017 (view article)

46. ECN – BTO Lays Foundation for a New Generation of Biotech, 2017 (view article)

45. Wall Street Journal – A Hardware Update for the Brain, 2017 (view article)

44. The New York Times – Defenders of the Faith in Government, 2017 (view article)

43. NPR – Electrical Stimulation to Boost Memory: Maybe It's All In the Timing , 2017 (view article)

42. The New York Times – Pacemaker for the Brain Can Help Memory, Study Finds, 2017 (view article)

41. Computerworld – DARPA: We're on the Cusp of Merging Human and Machine, 2017 (view article)

40. Scientific American – DARPA's Biotech Chief Says 2017 will "Blow Our Minds," 2017 (view article)

39. President Obama's Farewell Address – "I've seen our scientists help a paralyzed man regain his sense of touch." 2017 (view article)

38. DARPA – The LUKE Arm: Fulfilling a Promise to Wounded Warriors, 2016 (view article)

37. Pete Souza – President Obama Fist-Bumps the Robotic Arm of Nathan Copeland During a Tour at the White House Frontiers Conference, 2016 (view article)

36. The Washington Post – In a Medical First, Brain Implant Allows Paralyzed Man to Feel Again, 2016 (view article)

35. The Washington Times – Pentagon Plans Brain Implants to Restore Lost Memories, 2016 (view article)

34. Business Insider – The Military Just Built the Most Advanced Prosthetic Arm We've Ever Seen, 2016 (view article)

33. Mark Hamill – Innovative Prosthesis will Improve the Lives of Amputees-Astonished & Honored that Scientist have Named it "The Luke" (view article)

32. DARPA Celebrates International Year of Light, 2015 (view article) (view article)

31. Tech Insider – Forward to the Future: Visions of 2045, 2015 (view article) (view article)

30. White House – Back to the Future Day, 2015 (view article)

29. The Onion – New Prosthetic Hand Provides Sense of Touch, 2015 (view article)

28. DARPA - "Wait, What? A Future Technology Forum" – Neurotechnology, 2015 (view article)

27. CNN – Prosthetic Hand 'Tells' the Brain What it is Touching, 2015 (view article)

26. FOX News – Prosthetic Arm Restores Paralyzed Man's Sense of Touch, 2015 (view article)

25. The Economist – From Neurosis to Neurons, 2015 (view article)

24. Business Insider – DARPA Wants to Build a Personal Assistant that Can Read Your Mind, 2015 (view article)

23. Wired – Woman Controls a Fighter Jet Sim Using Only Her Mind, 2015 (view article)

22. President Obama State of the Union Address – A New Generation of Prosthetics, 2015 (view article)

21. ABC News – Brain Implant that could Restore Memory, 2014 (view article)

20. Signal – DARPA-Funded Research Offers Faster, Better Views of Entire Brain, 2014 (view article)

19. Defensenews – DARPA Revolutionizing Prosthetics Program, 2014 (view article)(view article)

18. Bloomberg Businessweek – Prosthetic Arm from Segway Inventor Approved by U.S. FDA, 2014 (view article)

17. NPR - DARPA SUBNETS Performer Selection, 2014 (view article)(view article)

16. Hagel Reviews Advances in Prosthetics and Brain, 2014 (view article)(view article)(view article)

15. DoD Live – General Dempsey Visits DARPA, 2014 (view article)

14. Newsweek – U.S. Military Leads Quest for Futuristic Ways to Boost IQ, 2014 (view article)

13. Nature – Neuroscience: Tuning the Brain, 2014 (view article)

12. Wall Street Journal – The Future of Brain Implants, 2014 (view article)

11. USA Today – Pentagon Researchers Seek Device to Help Restore Memory, 2013 (view article)

10. New York Times – Agency Initiative Will Focus on Advancing Deep Brain Stimulation, 2013 (view article)

9. TED – Invited Speaker – "Beyond Bionics" – Framing the Future (October 23, 2012) (view article) (view video)

8. NBC Latino – People – 'Doctor Hopes to Restore Motor Control to Paralyzed Patients' - (view article)

7. Miami New Times – People Issue – Most Interesting People in Miami 2011 (view article)

6. This Week in Tech (TWIT) - Futures in Biotech (FIB) (view article)

> PhDs Piled High and Deep (This podcast was ranked #5 in iTunes above the New England Journal of Medicine – December 16, 2011)

5. This Week in Tech (TWIT) - Futures in Biotech (FIB) (view article)

> Bionic Brain Symbionts: The Next Phage of Human Slurry
> Download Audio Podcast
> Download Video Podcast

4. This Week in Tech (TWIT) - Futures in Biotech (FIB) (view article)

> The Brain Machine Interface
> Download Podcast

3. Diagnosis: Paralysis (Ivanhoe Broadcast)

> Video

2. University of Florida Research Report

Video

1. Engadget - Researchers devise neural implant that learns over time, 2008 (view article)

Lectures

2025 Invited Panelist, "Disruptive Technology and Future Warfare," National Defense University's Institute for National Strategic Studies Conference, Washington, D.C.

2025 Invited Panelist, "Developing Robust Commercialization Pathways for Emerging Technologies in AI and HPC," ASTM/NAS Research Security Working Meeting, Washington, D.C.

2025 Invited Lecture, "How Artificial Intelligence is Transforming National Security & Corporate America," Ohio Corporate Security Symposium, Columbus, OH.

2023 Invited Panelist, "Battling Biothreats," Foreign Policy Simulation and Synthesis Report, Washington, D.C.

2023 Invited Lecture, "BioNet: The Internet of Distributed Biomanufacturing," Ohio State University, Biomanufacturing Opportunities Workshop, Columbus, OH.

2022 Invited Lecture, "Accelerating Human Performance S&T into Operational Missions," Human Performance & Biosystems Summit, Washington, D.C.

2022 Invited Lecture, "An Unlikely Journey to Breakthrough Technologies," 2022 STEMconnector & Million Women Mentors Summit: Innovating for the Future, Washington, D.C.

2022 Invited Panelist, "Biotechnology 101 with Dr. Justin Sanchez," NDIA Emerging Technologies Institute, Washington, D.C.

2022 Invited Lecture, "The Future of Neurotechnology is Now," Conrad Challenge, Virtual.

2020 Invited Panelist, "Innovations in Biotechnology," Financial Times Global Pharmaceutical and Biotechnology Conference, London.

2020 Invited Lecture, "Leadership in Government and Industry," Partnership for Public Service and the Excellence in Government Fellows program, Washington, D.C.

2020 Invited Panelist, "Synthetic biology and America's future: New opportunities for working with the U.S. government," Synbiobeta.

2020 Invited Lecture, "Biotechnology in National Security," National Defense University – Emerging Technologies Industry Study, Washington, D.C.

2020 Invited Panelist, "Boston Tech Hub Faculty Working Group session on Brain-Computer Interfaces," Harvard Kennedy School, Boston, MA.

2019 Invited Keynote, "Neurotechnology," C2 Creativity + Commerce, Montreal, Canada.

2019 Invited Panelist, Defense One Tech Summit, Washington, D.C..

2019 Invited Lecture, "The Future of Neurotechnology is Now," Dare Mighty Things, Chicago, IL.

2019 Invited Panelist, "Neurotechnology," Constellation Forum, New York, NY.

2019 Invited Lecture, "Leadership in Government," Partnership for Public Service and the Excellence in Government Fellows Program Fall 2019, Washington, D.C.

2019 Invited Panelist, "DOD Biodefense Science, Technology, Research, and Development," Blue Ribbon Study Panel on Biodefense, Washington, D.C.

2018 Invited Lecture, "Driving and Reshaping Biotechnology," Iowa State University, Ames, IA.

2018 Invited Lecture, "Driving and Reshaping Biotechnology," JHU APL Biotechnology for the Nation, Laurel, MD.

2018 Invited Lecture, "BioNext," IndieBio – DARPA BTO + Silicon Valley, San Francisco, CA.

2018 Invited Lecture, "BioNext," DARPA 60th, National Harbor, MD (view article).

2018 Invited Lecture, "Biological Technologies to Revolutionize Defense Capabilities," Defense Science Board, Arlington, VA.

2018 Invited Lecture, "Biological Technologies to Revolutionize Defense Capabilities," MIT Lincoln Lab Homeland Protection Workshop, Lexington, MA.

2018 Invited Lecture, "Neurotechnology," Wall Street Journal Future of Everything, New York City.

2018 Invited Lecture, "Driving and Reshaping Biotechnology," Carnegie Mellon University, Pittsburgh, PA.

2018 Invited Lecture, "National Security in the Age of Programmable Biotechnology," BDYHAX, Austin, TX.

2018 Invited Lecture, "Driving and Reshaping Biotechnology," Merck Curious 2018, Darmstadt, Germany.

2017 Invited Lecture, "BTO's Biology for Security," Defense Science Board, Arlington, VA.

2017 Invited Lecture, "DARPA's Biological Technologies Office," National Defense University, Washington, D.C.

2017 Invited Lecture, "DARPA's Biological Technologies Office," University of California San Francisco, San Francisco, CA.

2017 Invited Lecture, "DARPA's Biological Technologies Office," Georgia Tech Research Institute, Atlanta, GA.

2017 Invited Lecture, "Illuminating the Future of Brain-Machine Interfaces," Techonomy, Halfmoon Bay, CA (view article).

2017 Invited Lecture, "Beyond Science Fiction: DARPA and the Future of Brain Interfaces," Future Con, Portland, OR.

2017 Invited Lecture, "Neurotechnology: Bridging the Gap Between Mind and Machine," Paralyzed Veterans of America Summit, National Harbor, MD.

2017 Invited Lecture, "Neurotechnology: Bridging the Gap Between Mind and Machine," AAAS NeuroPolicy Group, Washington, D.C.

2017 Invited Lecture, "Direct Neural Interfaces," Thinking Digital, Newcastle, UK (view article).

2017 Invited Lecture, "DARPA's Biological Technologies Office," Defense Science Study Group, Arlington, VA.

2017 Invited Lecture, "DARPA's Biological Technologies Office," Ohio State University and Air Force Research Lab, Columbus, OH.

2016 Invited Lecture, "Bio/Tech: DARPA's Moonshots for the 21st Century," SXSW, Austin, TX.

2016 Invited Lecture, "Circuits of the Mind: Biology is the Model for The Ecorithm Era," Techonomy, Half Moon Bay, CA. (with Leslie Valiant).

2016 Invited Panelist, Cohen Veterans Care Summit, Washington, D.C.

2016 Invited Lecture, "DARPA's Innovations in Brain Function Research," Grand Rounds, Stanford University, Stanford, CA.

2016 Invited Lecture, "Frontiers in Neurotechnology," American Institute for Medical and Biological Engineering (AIMBE), Washington, D.C.

2016 Invited Lecture, "Vision for Wearable Neurotechnology," Wearable Tech + Digital Health + Neurotech NYC, New York, NY.

2015 Invited Panelist, "The BRAIN Initiative in 2015: Updates and Outreach," SfN Satellite Event, Chicago, IL (with Walter Koroshetz, Greg Farber, James Olds, Catherine Cotell, and Kristen Bowsher).

2015 Invited Lecture, "DARPA's Innovations in Direct Brain Interfaces for Restoration of Function," Neurocritical Care Society, Scottsdale, AZ.

2015 Invited Lecture, "DARPA's Advances in Neurotechnology for Brain Function Research," Naval Research Lab Karles Invitational Conference on Neuroelectronics, Washington D.C.

2015 Invited Keynote, "DARPA's Advances in Brain Function Research," ASET Neurodiagnostic Society Annual Conference, Weston, FL.

2015 Invited Panelist, "DARPA's SUBNETS and RAM Programs", Brain Futures 2015 – MHAMD Centennial Conference, Annapolis, MD (with Cori Lathan, Katherine W. Sullivan, and Sheilah Kast).

2015 Invited Lecture, "DARPA's Innovations in Biological Technology", Howard Hughes Medical Institute Janelia Campus, Ashburn, VA.

2015 Invited Panelist, "DARPA's BRAIN Function Research Portfolio", NIMH Training Day, Leesburg, VA.

2015 Invited Lecture, "DARPA's Advances in Neurotechnology for Brain Function Research," NIH Public Private Partnership Workshop, Bethesda, MD.

2015 Invited Presenter, "DARPA and the President's BRAIN Initiative," Institute of Medicine, Forum on Neuroscience and Nervous System Disorders, Washington, D.C.

2015 Invited Panelist, "Transforming HealthCare Through Technology," DC Chamber of Commerce, Washington, D.C. (with Chet Burrell, Chiledum A. Ahaghotu, Rollin J. Fairbanks, Antwanye Ford, Brian Jacobs) (view article).

2015 Invited Lecture, "DARPA's Innovations in Biological Technology," National Organization of Research Development Professionals, Bethesda, MD.

2015 Invited Lecture, "DARPA's Vision for Neuroscience in Support of the President's BRAIN Initiative," Association of Medical School Neuroscience Chairpersons, Monterey, CA.

2015 Invited Lecture, "DARPA's Advances in Brain Function Research," AAAS Neuropolicy Affinity Group, Washington D.C.

2014 DARPA Representative, "Federal Investment in the BRAIN Initiative – Current Activities, Long-Term Goals and Critical Components for Success," The White House BRAIN Conference, Washington D.C.

2014 Invited Lecture, "Revolutionizing Prosthetics," Portland International Neuroscience Symposium," Oregon Health and Science University Brain Institute, Portland Oregon.

2014 Invited Lecture, "DARPA and the Nature of Creativity in the Brain," National Endowment for the Arts Workshop on Creativity in the Brain, Santa Fe Institute, Santa Fe, NM.

2014 Invited Lecture, "DARPA Innovations in Neural Interface Technology," NIH Neural Interfaces Conference, Dallas, TX.

2014 Invited Lecture, "DARPA and Neuroscience," NeuroFutures – The University of Washington, Seattle, WA.

2014 Invited Lecture, "Data Sharing in the BRAIN Initiative," AAAS Neuroscience and Data Sharing Symposium, Washington, D.C.

2014 Invited Panelist, "Traumatic Brain Injury Panel," Brain Health Summit, Washington, DC (with GEN Chiarelli, Morgan Luttrell, Daryl Johnston, and Lori Cook)

2014 Invited Lecture, "DARPA's Brain Function Research Portfolio," Bioconference Live: Federal Agency Perspective on the BRAIN Initiative (with Tom Insel, Story Landis, John Wingfield).

2014 Invited Lecture, "The Science of DARPA's Brain Function Research," Bioconference Live: Science of the BRAIN Initiative (with Bill Newsome, Emery Brown, Terry Sejnowski).

2014 Invited Lecture, "Next-generation Neurotechnology at the Defense Advanced Research Projects Agency," AAAS NeuroPolicy Lecture Series, Washington, D.C.

2014 Invited Lecture, "Next-generation Neurotechnology at the Defense Advanced Research Projects Agency," NextMed, Manhattan Beach, CA.

2014 Invited Lecture, "How are bionics and biology advancing through technology?," NSA CYBERLINX 3, Baltimore, MD.

2014 Invited Lecture, "Revolutionizing Prosthetics," Amyotrophic Lateral Sclerosis (ALS) Association FLY-IN meeting, Washington, D.C.

2013 Invited Lecture, "DARPA Innovations in Brain Function Research," DoD Neuroscience Working Group, Arlington, VA.

2013 Invited Lecture, "DARPA Innovations in Brain Function Research," Institute of Medicine Forum on Neuroscience and Nervous System Disorders, Washington, D.C.

2013 Invited Lecture, "DARPA Innovations in Brain Function Research," IEEE Neural Engineering Conference, San Diego, CA.

2013 Invited Lecture, "Keynote Panel: Accelerating Neurotechnology Research – A Global Perspective," 4th Annual Aspen Brain Forum, Aspen, CO.

2013 Invited Lecture, "Neuroprosthetics: A new modality for therapeutic treatment of motor, sensory, and neuropsychiatric disorders," 14th International Congress on Schizophrenia Research, Orlando, FL.

2013 Invited Lecture, "Meet the Doctors: "Beyond Bionics" with Dr. Justin Sanchez," Coral Gables Museum, UM Community Outreach Program, Coral Gables, FL.

2012 Invited Lecture, "Neuroprosthetics for Treating Tourette Syndrome: New Insights from Deep Brain Stimulation," 4th Annual International Conference in Computational Surgery and Dual Training, Harvard, Boston, MA.

2012 Invited Lecture, "Building the Bionic Human," The Audrey R. Finkelstein Experience, Miami, FL.

2012 Invited Lecture, "Emerging Frontiers in Neural Enabled Technology," BioFlorida Conference, Miami, FL.

2012 Minisymposium, "Predicting Microelectrode Array Functionality using Biotic and Abiotic Metrics *In Vivo*," IEEE Engineering in Medicine and Biology Conference, Session on Futures in Reliable Neural Interfaces, panel included Patrick Tresco, Justin Williams and Kevin Otto, San Diego, CA.

2012 Invited Lecture, "Brain-Machine Interfaces in Neuromedicine," Department of Biomedical Engineering Summer Scholars Program, University of Miami, Miami, FL.

2012 Invited Lecture, “Designing ‘Intelligent’ Neuroprosthetics: Harnessing Multiscale Activity from Systems of Neurons,” State University of New York, Brooklyn, NY.

2012 Invited Lecture, “Brain-Machine Interfaces in Neuromedicine,” UM Chapter of the Society for Neuroscience, Coral Gables, FL.

2011 Invited Lecture, “Futures in Brain-Machine Interfaces: System and Computing Design Strategies,” IEEE Systems, Man, and Cybernetics Workshop on Brain-Machine Interfaces, Anchorage, Alaska.

2011 Invited Lecture, “Futures in Brain-Machine Interfaces: System and Computing Design Strategies,” School of Computing and Information Sciences Seminar Series, Florida International University.

2011 Minisymposium, “Brain-Machine Interfaces in Activities of Daily Living: Innovating a New Roadmap for Experimentation,” IEEE Engineering in Medicine and Biology Conference, Session on Futures in Brain-Machine Interfaces, panel included Leigh Hochberg, Krishna Shenoy and Jose Carmena, Boston, MA

2011 Minisymposium, “Decoding Tradeoffs in Multiscal Neuronal Recording for Brain-Machine Interfaces,” IEEE Engineering in Medicine and Biology Conference, Session on Recent Experiences in Non-Penetrating Micro-Electrodes in the CNS, panel included Mesut Sahin and Doug Webber, Boston, MA

2011 Invited Lecture, “Designing "Intelligent" Neuroprosthetics: Harnessing Multiscale Activity from Systems of Neurons,” Neuroscience Seminar Series, Florida Atlantic University and Max Plank Florida Institute, Boca Raton, FL

2011 Invited Lecture, “Progress in Brain-Machine Interfacing,” National Neurotrauma Symposium, Session on Bypassing CNS Damage with Electronics, panel included Hunter Peckham, and Ali Rezai, Hollywood, FL

2011 Invited Lecture, “Brain-Machine Interfaces in Neuromedicine: Harnessing the Coding of Behavior from Neural Ensembles,” Department of Biomedical Engineering Summer Scholars Program, University of Miami, Miami, FL

2011 Invited Lecture, “Translating Thoughts into Action: Innovating the Neuroscience and Computation of Brain-Machine Interfaces,” Neuroscience Program Special Seminar, University of Miami, Miami, FL

2011 Invited Lecture, “Intelligent Neuroprosthetics: System Design Strategies form Lab Bench to Patient Bedside,” Design of Medical Devices Conference, University of Minnesota, Minneapolis, MN

2011 BME 512 Invited Lecture, “Brain-Machine Interfaces,” Coral Gables, FL

2010 “Co-Adaptive, Symbiotic Neural Interfaces via Reinforcement Learning” and “Tissue, Electrical, and Material Reponses in Electrode Failure” DARPA Neural Engineering, Science, and Technology (NEST) Forum, San Diego, CA

2010 Invited Lecture, “Brain-Machine Interfaces in Neuromedicine: Harnessing the Coding of Behavior from Neural Ensembles,” Miami Project to Cure Paralysis, University of Miami, Miami, FL

2010 "Symbiotic Neuroprosthesis: Harnessing the Perception-Action-Reward Cycle," 4th International Brain-Computer Interface Conference, Monterey, CA

2010 Invited Lecture, "Symbiotic Neuroprosthesis: Harnessing the Perception-Action-Reward Cycle," International Brain Mapping and Intraoperative Surgical Planning Society, Washington, D.C.

2010 Grand Rounds, "The Perception-Action-Reward Cycle in Neuromedicine: Harnessing the Coding of Behavior from Neural Ensemble, Departments of Neurology and Neuroscience, University of Florida, Gainesville, FL

2010 Keynote Lecture, "Innovation in Brain-Machine Interfaces: How Margret Mead Impacted Neuroprosthetics for the 21st Century," Indiana-Purdue University, Society of Women Engineers Opportunity Banquet, Fort Wayne, IN

Press Coverage of Lecture
http://www.fox59.com/news/sns-bc-in--bionicsspeech,0,3940281.story

http://www.wthr.com/Global/story.asp?S=12114659

2009 Invited Panel Member, "Brain Machine Interfaces – A New Research Avenue for Cybernetics and System Science," International IEEE Conference on Systems, Man, and Cybernetics, San Antonio, TX

"Co-Evolution of Human and Machine: How Cybernetics has Impacted Neuroprosthetic Design"

2009 Workshop Beyond Brain Machine Interface: Motor, Cognitive, Virtual, IEEE International Conference of the Engineering in Medicine and Biology Conference, Minneapolis, MN,

"Cognitive Integration of Prosthetic Devices: Is it Feasible?"

2009 Invited Keynote Lecture, IEEE 125th Anniversary Conference on the History of Technical Societies, Philadelphia, PA

"Co-Evolution of Human and Machine: Neuroprosthetics in the 21st Century,"

2009 Invited Lecture, United Therapeutics – 2nd Annual Unither Nanomedical & Telemedical Technology Conference, Quebec, Canada

"Direct Brain-Machine Interfaces"

This talk will present new neurotechnologies for brain-machine interface (BMI) systems in humans. Included are techniques for neurophysiologic hardware design and methods for determining representation in multiscale signals for deriving communication and control. A new framework for continuous decoding based on reinforcement learning (RL) will be presented and it will be shown how principles of neural control can be studied through co-adaptive interaction between the user and the neural interface.

2009 Invited Lecture "Co-Evolution of Man and Machine: Neuroprosthetics in the 21st Century," Department of Biomedical Engineering, Biomedical Engineering Society, University of Florida, Gainesville, FL

2009 Invited Lecture, "Brain-Machine Interfaces," Department of Physical Therapy, Neuroplasticity and Rehabilitation Course, University of Florida, Gainesville, FL

2009 Invited Lecture, "Translating Thought into Action: A Computational Neuroscience Perspective," Department of Neuroscience, Educational and Research Retreat, University of Florida, Gainesville, FL

2008 Invited Lecture, Ohio State University Mathematical Biosciences Institute – Workshop on Real Time Brain Interfacing Applications, Columbus, Ohio

"Continuous Decoding of Intracortical Signals"

Closed-loop neural interfaces are one of the most exciting emerging technologies to impact biomedical research, human health, and rehabilitation. By combining engineering and neurophysiologic knowledge into bio-interactive brain-machine interfaces (BMI), a new generation of medical devices is being developed to functionally link large ensembles of neurons in the central nervous system (CNS) directly with man-made systems. This talk will present overview of the design and analysis of decoding methodologies for closed-loop BMI systems. Included are techniques for neurophysiologic feature detection and methods for determining representation in multiscale signals. Within the context of these traditional decoding approaches, a new method of continuous decoding based on reinforcement learning (RL) will be presented. New principles of neural control will be developed as they are learned through experience and interaction with the environment. It will be shown how a theory and method of co-adaptive shaping using RL to achieve brain control of a prosthetic enables the development of complex tasks while reducing the "learning curve" for patients using a BMI.

2008 Invited Lecture, Ohio State University Mathematical Biosciences Institute – Workshop on Real Time Brain Interfacing Applications, Columbus, Ohio

"The onset of seizure: New perspectives from neural ensemble activity *in vivo*"

The state-of-the-art in clinical epilepsy stimulation is faced with the challenge of specifying why some epileptic individuals respond to stimulation treatment and why others don't. To address this issue, we are investigating a chronic animal model of temporal lobe epilepsy to develop new treatments for the human condition. Here, we seek to advance the knowledge and technologies needed to produce more effective therapeutic stimulation paradigms by studying the onset of seizure from multiple neurophysiologic scales that are simultaneously recorded: single neuron, multiunit activity, and local fields. Our recent studies have shown that abnormal neuromodulation in pyramidal cells, interneurons, and population spikes occur in advance of impending seizures in the animal model.

2008 Invited Lecture, "Neuroprosthetic Design for Restoring Motor Function after Spinal Cord Injury," Johns Hopkins University, Baltimore, MD

2008 Invited Lecture, "Brain-Machine Interfaces for Restoring Motor Function after Spinal Cord Injury," Miami Project to Cure Paralysis, University of Miami, Miami, FL

2008 Invited Lecture, "Brain-Machine Interfaces for Restoring Motor Function after Spinal Cord Injury," Department of Physical Therapy, Rehabilitation Research Seminar Series, University of Florida, Gainesville, FL

2008 Invited Lecture, "Co-Adaptive Motor Control through Neuroprosthetic Interfaces," Center for

Neuropsychological Studies Lecture Series, University of Florida, Gainesville, FL

2008 Invited Lecture, "Brain-Machine Interfaces for Restoring Motor Function after Spinal Cord Injury," Brain Rehabilitation Research Center, University of Florida, Gainesville, FL

2007 EMBC Workshop on Brain-Computer Interfaces: Neurotechnology for Artificial Implants and Neural Prosthesis, IEEE Engineering in Medicine and Biology Conference (Co-organizer), Leon, France

Description:

Brain-Computer Interfaces (BCI) communicate directly with the nervous system to provide lost sensory input, repair connectivity between brain structures, or translate intention of movement to treat the paralyzed, blind, and deaf. The development of neural interface technology has grown exponentially over the last decade and continues to attract new researchers from multiple disciplines with expertise in biomaterials, signal processing, neurophysiology, mathematics, psychology, and robotics to name a few. BCIs utilize novel neurotechnologies including MEMS, neural signal processing, VLSI circuitry, and DSPs to bypass and restore function to damaged neural tissue or to augment existing neural systems. The vision of this workshop is to address the next "grand challenges" of brain-computer interfaces for scaling the computational abilities of encoding/decoding systems, innovating the realism of neural engineered systems, and establishing new bi-directional neural signal interfaces. This workshop will also overview the world state-of-the-art in BCI including recent innovations and contributions from in data driven experimental paradigms in special issues of the IEEE TNSRE and TBME, WTEC, and the Wadsworth Center.

2007 Workshop on Innovation in Computational Approaches for Brain-Machine Interfaces, International Joint Conference on Neural Networks (Co-organizer), Orlando, Florida

Description:

Brain-Machine Interfaces (BMI) communicate with the nervous system to provide lost sensory input, repair connectivity between brain structures, or translate intention of movement to treat the paralyzed, blind, and deaf. They require beyond state of the art electronics and data processing methods to effectively interact with the nervous system. Underlying these applications, we will discuss the computational challenges for understanding how individual neurons, neural circuits, and systems interact through spikes, LFPs, ECoGs, EEGs, and EMG to produce behavior. This workshop will also study recent innovations including the use of data driven experimental paradigms in animals and humans to improve the fundamental concepts and computational modeling framework for explaining the physiological relationships in real neural and behavioral datasets. New quantitative tools to extract and represent control features from multivariate datasets will be introduced.

2007 Organization of Engineering in Medicine and Biology Society (EMBS) Lecture Series – Guest Speaker Yongmin Kim – Past President of the IEEE EMBS, "Bioengineering, Translational Research, and Technology Commercialization"

2007 Invited Lecture "Translational Neuroprosthetic Research," Howard Hughes Science for Life Seminar Series, University of Florida, Gainesville, FL

2007 Invited Lecture "Overview of Neuroprosthetic Research," Department of Biomedical Engineering, Biomedical Engineering Society, University of Florida, Gainesville, FL

2006 Invited Lecture, "Chronic, Multisite, Microelectrode Recording in Temporal Lobe Epilepsy: Challenges and Implications for the Study of Spontaneous Seizures," Annual Meeting of the

American Epilepsy Society, Engineering and Epilepsy Special Interest Group Sensing the Brain in Epilepsy: Materials and Methods, San Diego, CA

2006 Invited Panel Member, "Choosing Multiscale Recordings for Epilepsy Research," NIH sponsored Second International Seizure Prediction Workshop, Seizure Generation: The Role of High Frequency Activity, Bethesda, MD

2006 Invited Lecture, "Selecting State Variables for ECoG Neuroprosthetics," Neuroengineering Now, University of Texas at Dallas, Dallas, TX

2006 Invited Lecture, "Choosing the Appropriate Level of Abstraction for Brain-Machine Interfaces: Data Collection and Analysis Insights," Conference on Data Mining, Systems Analysis, and Optimization in Neuroscience, University of Florida, Gainesville, FL

2006 Organization of Engineering in Medicine and Biology Society Lecture Series – Guest Speaker Walter Freeman – Professor of the Graduate School, "Contrasting the Roles of Cognition and Causality in Medicine, Engineering, and Biology"

2006 Workshop on Quantitative Neuroscience: Models, Algorithms and Applications, Guest Rodolfo Llinas (Co-organizer), Gainesville, Florida

2006 Invited Lecture, "Overview of Neuroprosthetic Research," Interdisciplinary Program in Biomedical Sciences Seminar, University of Florida, Gainesville, FL

2006 Invited Lecture, "Neuroprosthetics and Epilepsy: A Multiscale Approach," University of Florida Epilepsy Working Group, University of Florida, Gainesville, FL

2006 Invited Lecture, "Neuroprosthetic Design for the 21st Century," BME Seminar Series, Department of Biomedical Engineering, University of Florida, Gainesville, FL.

2006 Invited Lecture, "Current Controversies in Neuroscience and Behavior, Translating Thought into Action," Department of Psychology, University of Florida, Gainesville, FL

Technical and Scientific Committees

2021 Harvard Tech Spotlight Selection Committee (Former Defense Secretary Ash Carter, Chair)

2016 Program Co-Chair: IEEE Engineering in Medicine and Biology Conference

2014 Member: EMBS Neuroengineering Technical Committee

2013 Program Chair: IEEE Neural Engineering Conference

2013 Track Chair: IEEE EMBC Neural control of movement and robotics applications

2013 Track Chair: IEEE EMBC Motor neuroprostheses of Neural and Rehabilitation Engineering

2013 Program Committee: IEEE Engineering in Medicine and Biology Conference

2012-2016	Permanent Member National Institutes of Health (NIH) Bioengineering of Neuroscience, Vision, and Low Vision Technologies Study Section
2012	Program Committee: IEEE Systems Man and Cybernetics Conference
2011-2014	Elected Member: IEEE Engineering in Medicine and Biology Society Administrative Committee (AdCom), term January 1, 2012-December 31, 2014
2011	Member Student Paper Competition Committee: IEEE Engineering in Medicine and Biology Conference
2011	Co-Chair: Brain-Machine/Brain-Computer Interfaces (BMI/BCI) IEEE CAS-FEST Workshop, Rio de Janeiro, Brazil (w/ Mohamad Sawan, Paul Sajda, and Pedram Mohseni)
2011	Track Chair: Neural Signal Processing at IEEE Neural Engineering Conference, 2011
2010	Co-Chair: IEEE SMC Technical Committee on Brain-Machine Interfaces
2010	Session Chair: Models and Methods Inferring Neural Circuits at IEEE EMBC 2010
2010	Track Chair: Neural Microsystems and Interface Engineering at IEE EMBC 2010
2010	Session Chair (w/ Leigh Hochberg): International Brain Mapping Society International Conference, Brain-Machine Interfaces I and II (Invitees included John Donoghue, Andrew Schwartz, Jon Wolpaw, Syd Cash, Nitish Thakor, Geoff Ling)
2010	Workshop Co-Chair (w/ Bin He) "Applications of BCI for Communication and Control (red team): 4th International Brain-Computer Interface Conference
2010	Selection Committee: 4th International Brain-Computer Interface Conference
2009	FDA Consultant: Neurological Devices Panel at the Food & Drug Administration in the Center for Devices and Radiological Health (CDRH)
2009	Session Chair: Asilomar Conference on Signals, Systems, and Computers, Brain Machine Interfaces I
2009	Program Committee: 4th International Conference on Neural Engineering
2006	Program Committee: 3rd International Conference on Neural Engineering
2006	Associate Editor: 3rd International Conference on Neural Engineering
2006	Session Co-Chair, Engineering in Medicine and Biology Conference, Neuromuscular Control: Central Mechanisms

Federal Grant Review (while in Academia)

2016	Grant Review Panel: BNVT
2015	Grant Review Panel: BNVT/B-53

2014	Grant Review Panel: 2014/5 BNVT (Bioengineering of Neuroscience, Vision and Low Vision Technologies Study Section)
2013	Grant Review Panel: BNVT
2012	Grant Review Panel: NT, ZRG1 ETTN-B 80, and ZRG1 ETTN-B 30
2011	Grant Review Panel: ZRG1 ETTN-B 80 S and ZRG1 ETTN-B 30 I
2011	Grant Review Panel: NIH ZRG1 ETTN-K (10) B
2011	Grant Review Panel: NIH ZDC1 SRB-R(31)
2011	Grant Review Panel: NIH ZRG1-ETTN-C(02) Special Emphasis
2010	Grant Review Panel: NIH ZRG1-ETTN-K(10) SBIR
2010	Grant Review Panel: NIH ZRG1 ETTN-B (90) S DARPA
2010	Grant Review Panel: Department of Defense, United States Army Medical Research and Materiel Command, Congressionally Directed Medical Research Programs, 2009 Spinal Cord Injury Research Program
2009	Grant Review Panel: NIH ZRG1 ETTN-A (58) R RFA OD09-003 Challenge Grants Panel # 12
2009	Grant Review Panel: NIH ZRG1 ETTN-C (02) M, Clinical Neurophysiology, Devices, Auditory Devices and Neuroprosthesis SEP
2009	Grant Review Panel: US Army Medical Research and Material Command (USAMRMC)
2008	Grant Review Panel: NIH ZRG1 ETTN-E 10 S, Clinical Neurophysiology, Devices, Auditory Devices and Neuroprosthesis Small Business SEP
2008	Grant Review Panel: The Wellcome Trust
2007	Grant Review Panel: Portuguese Science and Technology Ministry
2005	Grant Review Panel: National Sciences and Engineering Research Council of Canada

Patents and Copyrights

11. Colachis, S., Meyers, E., Sanchez, J., and Friedenberg, D. Delivery of Somatosensation for Medical Diagnostics or Guiding Motor Action, filed May 2022.

    Significance: We have developed a device for delivering somatosensation. A garment is wearable on a body part, and includes an array of electrodes in electrical contact with skin of the body part when the garment is worn on the body part. An electronics module is configured to use the array of electrodes of

the garment to apply a somatosensation pattern providing guidance in performing a motor action, or providing a pain sensation to the wearer.

10. Colachis, S., Meyers, E., Sanchez, J., and Friedenberg, D. Non-verbal Communications Radio with Non-Verbal Communication System Using a Plurality of Nonverbal Communication Radios, filed May 2022.

    Significance: We have developed a novel form of communication by transmitting semantic messages determined from EMG signals measured using an array of electrodes and EMG receive circuitry. The communications radio includes a garment wearable on the body part with the array of electrodes in electrical contact with skin of the body part to enable silent communications.

9. Roset, S. and Sanchez, J., Method for Improved Rehabilitation with an Adaptive Rehabilitation Controller, filed October 2012.

    Significance: We have developed a system that uses Responsive NeuroRehabilitation (RNR) to induce plastic changes in CNS neuronal representation. The RNR system uses rehabilitation training with feedback to induce changes in the size and location of cortical maps after injury.

8. Mahmoudi, B. and Sanchez, J., *Method of Adaptive Neural Decoding using Localized Synaptic Processing and Evaluative Feedback,* filed May 2012.

    Significance: Using knowledge we have gained from the basic physiology, we have developed a biologically inspired form of neural decoding. The major development is that the adaptation of the model is performed by synaptic changes (strengthening or weakening) to computational neurons using evaluative feedback from the environment. This new update method improves performance by making modifications on a local basis. In addition, we determined this method is less sensitive to the initial conditions of the parameters. Using a fundamental synaptic efficiency update that is local to each neuron also helps to keep output actions competitive, speeds learning of good actions, and penalizes bad actions that do not lead to completing the goal of the decoding. In addition, we have determined that this method's performance is better under perturbed conditions where neural inputs can be compromised. Other decoding methods do not use this kind of update and feedback.

7. Sanchez, J., Nishida, T. N., Harris, J. G., Principe, J. C., Craciun, S., Morrison, S., Darmanjian, S., Cheney, D., Cieslewski, G., Gugel, K., *PICO: Portable Interface for Cognitive Output,* filed March 29, 2010, UF #13401

    Significance: The PICO system which stands for Portable Interface for Cognitive Output is wireless telemetry system that collects and processes locally the neural output. This portable hardware platform can decode the neural information and express the intent of the subject by performing a plethora of algorithms ranging from linear to nonlinear, feed-forward to feedback and reinforcement learning algorithms. The PICO system can also communicate and control prosthetic devices via processed brainwaves or can simply send this neural information by utilizing many of pr own compression algorithms. This disclosure concerns innovations in neuroprosthetics that enable a portable neural analysis system to serve as a potential therapy for patients suffering from a host of neurological disorders and also to provide a hardware platform that enable neurophysiologists to analyze and decode neural data ranging from EEG, ECOG and Local Field Potential (LPF) to single neural spike trains. The device is realized via a low power amplifier, a reconfigurable device (CPLD) and low power computational devices (DSP and microprocessor). This system is designed to easily interface with implanted electrodes but can also acquire EEG and ECOG neural data for onboard data analysis.

6. Sanchez, J., Mann, G. D., Crary, M. A., *Automated Swallow Frequency Meter,* filed November 17, 2010, UF #13402

Significance: This invention is directed to a wearable meter that is capable of recording swallowing sounds and can quickly process them to determine if they are of normal or abnormal nature.

5. Sanchez, J., Nishida, T. N., Harris, J. G., Principe, J. C., Bashirullah, R., *Wireless Implantable Neural Electrode System,* filed May 23, 2008, UF #12879

   Significance: The invention is directed to an implantable neural electrode system. More particularly, the neural electrode system, according to various embodiments, can be characterized as an ultra-low-power wireless implantable neural electrode system. In various embodiments, the system can provide a neural interface that serves as a potential therapy for patients suffering from a host of neurological disorders in the central or peripheral nervous system. The system also can provide a neural interface with neural tissue for recording, as well as stimulating, neural activity in a research subject or patent.

4. DiGiovanna, J. F., Mahmoudi, B. M., Mitzelfelt, J., Principe, J. C., Sanchez, J. C., *Co-adaptive brain machine interface control based on reinforcement learning*, filed April 27, 2007.

   Significance: A brain machine interface (BMI) architecture that can translate neural activity into goal directed behaviors without knowledge of the physical manifestation of the behaviors themselves for the control of computers or prosthetic devices. The 'state of the art' currently requires a patient to physically make movements to train the BMI control systems (supervised learning based BMI). Here, we have developed a semi-supervised BMI control architecture that uses reinforcement learning (RL) to co-adaptively find the neural state to motor mapping in goal-directed tasks. This invention addresses an unmet need for BMI users: paralyzed patients (or patients with other motor neuropathies) are unable to generate the movement trajectories necessary for BMI training.

3. Nishida, T. N., Patrick, E., Sanchez, J. C., US Patent No. 8,170,638, entitled *MEMS Flexible Substrate Neural Probe and Method of Fabricating Same*, filed September 11, 2006, UF# 12173; Attorney Docket No. 5853-680P

   Significance: For brain machine interfaces, the ultimate application of a fully implantable device warrants the need for integration between the amplifiers and electrode arrays. We designed a novel neural microelectrode that leverages the recording properties of conventional micro-wire electrode arrays with additional features such as the precise control of the electrode geometries and bond pad sites and flexible materials via micromachining. The Electrode arrays have high neuronal yield, which improves the accuracy and performance characteristics.

2. Sanchez, J. C., Carney, P. R., U.S. Provisional Application No. 60/716,863 entitled *Closed-Loop Micro-Control System for Predicting and Preventing Epileptic Seizures*, filed September 14, 2005, UF# 11930, Attorney Docket No.: 63815(49163).

   Significance: The invention generally relates to the prediction and intervention of seizures in subjects with epilepsy and related disorders. The device could help to revolutionize the treatment of many forms of intractable epilepsy in humans.

1. Nishida, T. N., Xie, H., Patrick, E., Sanchez, J. C., Provisional Application No. 60/686,275 entitled *Neural Probe and Methods for Manufacturing Same*, filed June 1, 2005, UF# 11863; Attorney Docket No. 5853-628P.

   Significance: This device allows patients suffering from movement disabilities, such as those resulting from spinal cord injury or stroke, to regain mobility. This interface design collects and can actively

target neural activity information directly from the cortex, interprets it, and delivers therapy via an electronic interface.

PUBLICATIONS

Books

[3] J. C. Sanchez, *Neuroprosthetics: Principles and Applications*. New York: CRC Press, 2016.
[2] J. C. Sanchez and J. C. Principe, *Brain-Machine Interface Engineering*. New York: Morgan and Claypool, 2007.
[1] J. C. Sanchez and J. C. Principe, "Optimal Signal Processing for Brain-Machine Interfaces," in Handbook of Neural Engineering, M. Akay, Ed. New York: Wiley, 2006.

Journals

[51] Sanchez, J. C., Brandenberger, J. M., Engel-Cox, J. A, Heintz, A. M., and Muehleisen, R. T., "Editorial: Innovations in climate resilience", Front. Environ. Sci. 12:1401203. doi: 10.3389/fenvs.2024.1401203, 2024.
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[45] B. Mahmoudi, E. A. Pohlmeyer, N. Prins, S. Geng, and J. C. Sanchez, "A hebbian reinforcement learning decoder for brain-machine interfaces," Society for Neuroscience, New Orleans, LA, 2012.
[44] M. S. Sandhu, V. M. Spruance, D. M. Baekey, E. J. Gonzalez-Rothi, N. G. Maling, M. A. Lane, P. J. Reier, J. C. Sanchez, and D. D. Fuller, "Brief respiratory stimulation with hypoxia alters cervical interneuron activity," Society for Neuroscience, New Orleans, LA, 2012.
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[37] B. Mahmoudi, E. Pohlmeyer, A. Prasad, and J. C. Sanchez, "Brain-Machine Interfaces in Activities of Daily Living: Innovating a New Roadmap for Experimentation," in IEEE International Conference of the Engineering in Medicine and Biology Society, Boston, MA, 2011. (1 page, Mini-Symposium)
[36] A. Prasad, E. Pohlmeyer, B. Mahmoudi, and J. C. Sanchez, "Decoding Tradeoffs in Multiscal Neuronal Recording for Brain-Machine Interfaces," in IEEE International Conference of the Engineering in Medicine and Biology Society, Boston, MA, 2011. (1 page, Mini-Symposium)
[35] K.-Z. Lee, M. A. Lane, B. J. Dougherty, L. M. Mercier, J. C. Sanchez, P. J. Reier, and D. D. Fuller, , "Functional integration of fetal spinal cord tissue following transplantation into a high cervical spinal cord lesion in adult rats," 7th Congress of the Federations of Asian and Oceanian Physiological Societies, Taipei, Taiwan, 2011. Abstract Y27.
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intermittent hypoxia training in cervical spinal cord injured rats," Society for Neuroscience, Washington, D.C., 2011. (Selected for Neuroscience 2011's pool of newsworthy research)

[33] H. Gonzalez, S. Geng, J. C. Sanchez, "Novel approaches in biocompatibility and neuronal decoding for Neuroprosthetics," UM Research, Creativity, and Innovation Forum, Coral Gables, FL 2011. (This poster received 3rd place in the 2011 UM Undergraduate Competition for Research, Creativity, and Innovation Forum).

[32] N. G. Maling, M. S. Okun, K. D. Foote, and J. C. Sanchez, "Relationship between local field potentials and tics in a Tourette Patient," 2011 National Predoctoral Clinical Research Training Program Meeting, St. Louis, FL 2011.

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[30] M. A. Crary, J. C. Sanchez, G. Carnaby-Mann, P. Carvajal, L. Sura, S. Lin, A. Rampersand, "Accuracy of Computer Algorithms in the Identification of Swallows by Acoustic Signal," Dysphagia Research Society, San Antonio, TX, 2011.

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[26] B. Mahmoudi, J. C. Principe, J. C. Sanchez, "Brain-Machine Interface Reward Learning in Changing Environments," 4th International Brain-Computer Interface Conference, Monterey, CA, 2010.

[25] J. C. Sanchez, G. Srivastava, P. Carvajal, A. S. Rampersad, L. Sura, G. Mann, M. A. Crary, "Initial Validation of a Swallow Frequency Meter," American Speech-Language and Hearing Association Annual Convention, Philadelphia, PA, 2010.

[24] J. C. Sanchez, B. Mahmoudi, "Mapping the Perception-Action-Reward Cycle in Neuroprosthesis Design: Harnessing the Neural Coding of Value-Based Decision Making," International Brain Mapping Society International Conference, Uniformed Service University Health Science, Maryland, 2010.

[23] N. G. Maling, M. S. Okun, K. D. Foote, and J. C. Sanchez, "Neurophysiology of Tourette Syndrome: The Potential for New Therapy using Deep Brain Stimulation" UF College of Medicine Celebration of Research, Gainesville, FL, 2010.

[22] J. C. Principe and J. C. Sanchez, "Cognitive Integration of Prosthetic Devices: Is it Feasible?" Army Research sponsored Non-Manual Control Devices Symposium, Minneapolis, MN, 2009.

[21] B. Mahmoudi, and J. C. Sanchez, "Completing the Loop: A Perception-Action Perspective on Neural Interface Design," International Conference of the Biomedical Engineering Society, Pittsburgh, PA, 2009.

[20] B. Mahmoudi, J. DiGiovanna, J. C. Principe, J. C. Sanchez, "Extracting Goal Information from Nucleus Accumbens for Brain-Machine Interface Design," International Conference on Cognitive and Neural Systems, Boston, MA, 2009.

[19] J. Digiovanna, B. Mahmoudi, J. Fortes, J. C. Principe, J. C. Sanchez, "Co-Adaptive Brain-Machine Interfaces via Reinforcement Learning," in NIH Neural Interfaces Conference, Cleveland, OH, 2008.

[18] S. Roper, J. C. Sanchez, H.-X. Chen "4-Aminopyridine Produces Increased Excitability but Decreased Time-Dependent Variability in Excitatory Synaptic Activity in the Neocortex," in 62nd Annual Meeting of the American Epilepsy Society, Seattle, WA, Epilepsia, 2008.

[17] J. C. Sanchez, J. C. Principe, J. Digiovanna, and B. Mahmoudi, "Co-Adaptive Brain-Machine Interfaces via Reinforcement Learning," in Conference on Computational Neuroscience, Gainesville, FL, p. 25, 2008.
[16] B. Mahmoudi, J. Digiovanna, J. C. Principe, J. C. Sanchez, "Neuronal Shaping in a Co-Adaptive Brain-Machine Interface," in Computational and Systems Neuroscience, Salt Lake City, UT, p. 170, 2008.
[15] J. Mitzelfelt, J. C. Sanchez, "Temporal Correlation of Single Neuron Firing Rates with Interictal Spikes during the Development of Temporal Lobe Epilepsy," in 61st Annual Meeting of the American Epilepsy Society, Philadelphia, PA, Epilepsia, vol. 48, p. 298, 2007.
[14] J. Mitzelfelt, W. Yan, J. C. Principe, J. C. Sanchez, "Simultaneous Analysis of Population Spikes and Single Neuron Activity *In Vivo* at the Onset of Seizure," in 3rd International Workshop on Epileptic Seizure Prediction, Freiberg, Germany, p. 45, 2007.
[13] J. Mitzelfelt, J. C. Sanchez, "Determining the Mechanisms of Seizure Onset *In Vivo* using the Firing Patterns of Pyramidal Cells and Interneurons," in The 37th annual meeting of the Society for Neuroscience, San Diego, CA, p. 492.5, 2007.
[12] H. Sepulveda, L. Hoang-Minh, M. B. Parekh, A. Hadlock, W. Norman, J. C. Sanchez, P. R. Carney, and T. H. Mareci, "Repeatable in vivo MR Imaging of Rats with Chronically Implanted Electrodes at 11.1 Tesla," in 48th Experimental NMR Conference, Daytona Beach, FL, p. E070361.5375. 2007.
[11] J. C. Sanchez, A. Gunduz, P. R. Carney, and J. C. Principe "Extraction and Localization of Mesoscopic Motor Control Signals for Human ECoG Neuroprosthetics," in 2nd Annual Neuromuscular Plasticity Symposium, Gainesville, FL, 2006.
[10] J. C. Sanchez, "Selecting State Variables for ECoG Neuroprosthetics," in Neuroengineering Now, Dallas, TX, p. 20, 2006.
[9] J. C. Sanchez, Z. Liu, and P. R. Carney, "Identifying the Seizure Onset Zone using Amplitude Modulated Slow Potentials, Gamma, Fast Gamma, and Neural Ensemble Activity," in 60th Annual Meeting of the American Epilepsy Society, San Diego, CA, Epilepsia, vol. 47, p. 148, 2006.
[8] L. Hoang-Minh, H. Sepulveda, M. B. Parekh, A. Hadlock, W. Norman, J. C. Sanchez, W. L. Ditto, M. A. King, P. R. Carney, and T. H. Mareci, "MRI measurements at 17.6 Tesla in an Animal Model of Mesial Temporal Lobe Epilepsy Correlated with Histological Analysis," in 60th Annual Meeting of the American Epilepsy Society, San Diego, CA, Epilepsia, vol. 47, p. 309, 2006.
[7] M. B. Parekh, L. Hoang-Minh, H. Sepulveda, A. Hadlock, W. Norman, J. C. Sanchez, W. L. Ditto, P. R. Carney, and T. H. Mareci, "Diffusion Tensor MR Imaging of the Rat Model of Mesial Temporal Lobe Epilepsy," in 60th Annual Meeting of the American Epilepsy Society, San Diego, CA, Epilepsia, vol. 47, p. 317, 2006.
[6] H. Sepulveda, L. Hoang-Minh, M. B. Parekh, A. Hadlock, W. Norman, J. C. Sanchez, W. L. Ditto, P. R. Carney, and T. H. Mareci, "Evolution of Temporal Lobe Epilepsy Observed with 11.1 Tesla MRI in vivo," in 60th Annual Meeting of the American Epilepsy Society, San Diego, CA, Epilepsia, vol. 47, pp. 320-321, 2006.
[5] D. Wang, J. C. Sanchez, K. D. Foote, A. Sudhyadham, M. T. Bhatti, S. Lewis, and M. S. Okun, "Intraoperative Recordings of Red Nucleus Physiology in a Patient with Failed DBS for Oculopalatal Tremor," in the Movement Disorder Society's 10th International Congress of Parkinson's Disease and Movement Disorders, Kyoto, Japan, p. 127, 2006
[4] J. C. Sanchez, J. C. Principe, and P. R. Carney, "Choosing the Appropriate Level of Abstraction for Brain Machine Interfaces: Data Collection and Analysis Insights," in Data Mining, Systems Analysis and Optimization in Neuroscience, Gainesville, Florida, p. 43, 2006
[3] E. Patrick, N. Perez-Garcia, M. Orazem, J. C. Sanchez and T. Nishida, "Electrochemical Impedance Spectroscopy of Neural Probe Polymer Insulation," in 209th Meeting of The Electrochemical Society, Denver, Colorado, vol. 601, p. 1173, 2006.
[2] J. C. Sanchez, P. R. Carney, T. H. Mareci, and W. M. Norman, "Multiscale Electrophysiological Analysis and Imaging in an Animal Model of Limbic Epilepsy," in 59th Annual Meeting of the American Epilepsy Society, Washington, D.C., Epilepsia, vol. 46, pp. 10-11, 2005.

[1] J. C. Sanchez, J. C. Principe, J. G. Harris, T. Nishida, and R. Bashirullah, "Brain-Machine Interfaces: Computational Approaches and Hybrid Hardware Development for Multi-Channel Neural Data Analysis," in Brain-Computer Interface Technology: Third International Meeting, Rensselaerville, NY, p. 22, 2005.

PREVIOUS FEDERAL FUNDING (while in academia)

Title: Responsive NeuroRehabilitation using an Advanced Brain Monitoring BCI
Effective Dates: 2012-2013
Funding Agency: DARPA (Subcontract for project W31P4Q-12-C-0200)
Role: PI
Total Award: $240,000

Title: Fully Implantable Brain-Machine Interface for Humans with Spinal Cord Injury
Effective Dates: 2012-2013
Funding Agency: Medtronic
Role: PI
Total Award: 10 Prototype Devices

Title: Training Novel Host-Graft Circuits to Enhance Spinal Cord Repair
Effective Dates: 04/01/2011-3/31/2013
Funding Agency: NIH (R21)
Role: Co-PI
Total Award: $397,260

Title: Tissue, Electrical, and Material Responses in Electrode Failure
Effective Dates: 2010-2013
Funding Agency: DARPA
Role: Principal Investigator UM Contract
Sanchez Contract: $715,633 ($211,478 indirect)
Total Project Budget: $2,129,244

Title: Creating the Synthetic Brain Through Hybrid Computational and Biological Systems: Repairing and Replacing Neural Networks
Effective Dates: 2010-2013
Funding Agency: DARPA (N66001-10-C-2008)
Role: Principal Investigator UM Contract
Sanchez Contract: $1,463,944 ($405,746 indirect)
Total Project Budget: $12,877,705

Title: Neural Correlates of Tourette Syndrome
Effective Dates: 9/1/2010-8/31/2012
Funding Agency: NIH R21
Role: Principal Investigator (MPI Program)
Total Award: $402,145 ($91,256 indirect)

Title: An Ultra-Low Power Wireless Neural Recording Implant Based on a Novel Pulse Representation
Effective Dates: 2007-2011
Funding Agency: NIH/NIBIB (1R01- NS053561-01A2)
Role: Co-Principal Investigator
Sanchez Budget: $283,966 ($85,875 indirect)
Total Project Budget: $1,610,076

Title: DDDAS-TMRP: Dynamic Data-Driven Brain-Machine Interfaces
Effective Dates: 2006-2009
Funding Agency: NSF (CNS-0540304)
Role: Co-Principal Investigator
Direct Cost: $702,137 (Sanchez Share: $167,121)
Indirect Cost: $233,863 (Sanchez Share: $46,561)
Total Award: $936,000 (Sanchez Share: $213,682)

Title: MRI: Acquisition of Biocomputing Cyberinfrastructure for Coupled Experimental-Computational Research
Effective Dates: 7/1/2008-6/3/2012
Funding Agency: NSF (MRI NSF 08-503)
Role: Co-Principal Investigator
Direct Cost: $1,311,108
Total Award: $1,311,108

Title: A Brain-Computer Interface for Stroke Rehabilitation
Effective Dates: 6/1/2010-6/1/2012
Funding Agency: University of Florida
Role: Principal Investigator
Total Award: $ 75,000

Title: A Neuroprosthetic Training System (NETS): Using Virtual Reality to Treat Paralysis
Effective Dates: 6/1/2009-6/1/2011
Funding Agency: University of Florida
Role: Co-Principal Investigator
Total Award: $63,271

Title: Development and Initial Validation of a Swallow Frequency Meter
Effective Dates: 6/1/2009-6/1/2010
Funding Agency: University of Florida Clinical and Translational Science Institute
Role: Co-Principal Investigator
Total Award: $24,720

Title: Howard Hughes Medical Institute: Group Advantaged Training of Research
Effective Dates: 1/1/2009-1/1/2010
Funding Agency: HHMI
Mentor to Babak Mahmoudi
Total Award: Half-time summer research assistantship with tuition waiver

Title: Restoration of Interneurons in an Animal Model of Cortical Dysplasia
Effective Dates: 2006
Funding Agency: McKnight Brain Institute Research Initiative, University of Florida
Role: Co-Principal Investigator
Total Award: $30,000

Title: Neurorehabilitative Technologies for the Treatment of Neurologic Disorders
Effective Dates: 2005
Funding Agency: Children's Miracle Network (CMN)
Role: Principal Investigator
Total Award: $18,000

Title: Neurorehabilitative Technologies for the Treatment of Neurologic Disorders
Effective Dates: 2005
Funding Agency: Brain and Spinal Cord Injury Rehabilitation Trust Fund (BSCIRTF)
Role: Co-Principal Investigator
Total Award: $15,000

EDITORIAL RESPONSIBILITIES

Associate Editor:

2012-2016 *IEEE Transactions on Biomedical Engineering*

2009-2016 *IEEE Transactions on Neural Systems and Rehabilitation Engineering*

2011 *IEEE Systems Man and Cybernetics – B (guest Associate Editor)*

2011 *IEEE Journal on Emerging and Selected Topics in Circuits and Systems (guest Associate Editor)*

2006-2013 *Open Biomedical Engineering Journal*

2005-2007 *Computers in Biology and Medicine*

Reviewer:

2015-2019 *Journal of Bioethical Inquiry* (1-2 papers/yr)

2014-2019 *Science Translational Medicine* (1-2 papers/yr)

2013-2019 *Parkinsonism & Related Disorders* (1-2 papers/yr)

2012-2019 *Journal of Neuroscience* (1-2 papers/yr)

2011-2019 *Journal of Online Visual Experiments (1-2 papers/yr)*

2010-2019 *International Brain Mapping and Intraoperative Surgical Planning Society (1 papers/yr)*

2009-2019 *Frontiers in Physiology* (1-2 papers/yr)

2009-2019 *Computational Intelligence and Neuroscience* (1-2 papers/yr)

2009-2019 *IEEE Transactions on Signal Processing* (1-2 papers/yr)

2009-2019 *EURASIP Journal on Advances in Signal Processing* (1-2 papers/yr)

2008-2019 *NeuroImage* (1-2 papers/yr)

2008-2019 *Spinal Cord* (1-2 papers/yr)

2008-2019 *Journal of Biological Chemistry* (1 paper/yr)

2006-2019 *Open Biomedical Engineering Journal* (1-2 papers/yr)

2005-2019 *Computers in Biology and Medicine* (1-2 papers/yr)

2005-2019 *Journal of Neural Engineering* (1-2 papers/yr)

2005-2019 *Neurocomputing* (1-2 papers/yr)

2004-2019 *IEEE Trans Neural Networks* (1-2 papers/yr)

2004-2019 *IEEE Trans Neural Systems & Rehabilitation Engineering* (1-2 papers/yr

2003-2019 *IEEE Trans Biomedical Engineering* (1-2 papers/yr)

2003-2019 *International Joint Conference on Neural Networks* (1-2 papers/yr)

2003-2019 *Engineering in Medicine and Biology Conference* (1-2 papers/yr)

2003-2019 *Neural Engineering Conference* (1-2 papers/yr)

PROFESSIONAL AND HONORARY ORGANIZATIONS

2012-2013 Senior Member, IEEE

2011-2013 Member, Society for Neuroscience (SfN)

2011-2013 Member, Neural Control of Movement Society (NCM)

2010-2013 Member, IEEE Systems, Man, and Cybernetics (SMC)

2005-2013 Member, American Epilepsy Society

2000-2013 Member, Institute of Electrical and Electronics Engineers (IEEE)

2000-2013 Member, Engineering in Medicine and Biology Society (EMBS)

TEACHING (while in academia)

Integrated Medical and Engineering Education

Through the development of a new neuroprosthetic programmatic theme, my laboratory has offered the opportunity for an educational experience that bridges the clinical and research environments. The goal has been to develop new programs and enhance existing programs around multidisciplinary environments that are free of barriers. The specific goals are as follows:

- Provide engineering and medical students with new neural engineering learning experiences with an emphasis on experimental design and data analysis.
- Develop a computational neuroscience curriculum in the Colleges of Engineering and School of Medicine.
- Provide practical tech transfer experience (translational medical device development, integration with industry, patient interaction, real-time wet lab experiments) to undergraduate and graduate students in order to promote careers in biomedical technology research.
- Recruit pre-college and college students for neuroprosthetic projects

Innovative Computational Neuroscience Courses and Curricula:

Neural Engineering – NeuroMotor Systems (BME 631): This is an advanced level course for Biomedical Engineering graduate students. Topics covered include neuromotor communication in the nervous system, electrical stimulation of neural tissue, closed-loop design of neural engineered systems, brain-machine interfaces, and neural rehabilitation. Upon successful completion of this course, students will: 1. Understand the fundamentals of NeuroMotor physiology (CNS to Muscle), 2. Understand the engineering principles NeuroMotor interfaces, 3. Understand and apply engineering solutions to neural communication and its application to NeuroMotor medical devices.

Fundamentals of Computational Neuroscience (BME 555): This course is for students with an interest in systems neurophysiology, neural computation, and experimental neurophysiological analysis and presents the major concepts of neural signaling and communication from the single neuron to systems of neural ensembles. We discuss the role of neural computation for advancing knowledge of information-processing in the brain. Examples are given for how experimental data can be summarized and predicted through computational modeling. Whenever possible, computer simulations are used to provide real examples for student experimentation. In the past two years, the neurobiological and computational topics presented were relevant to registered students of different backgrounds, which included neuropsychology, neuroscience, biomedical engineering, materials engineering, and electrical engineering.

Masters BME Design (BME 605): This emphasis of this course is on the practical, hands-on approach to biomedical device design. Students learn the principles of the device design process and the integration of multidisciplinary expertise, technical activities, standards, regulatory requirements, and administrative project controls. Through the generation of a project design proposal, students learn which factors impact current and future project progress. Many students enrolled in this course go on to industry.

Neuroscience 2 (NEU 662): This course is team-taught and designed to train 2nd year Neuroscience students in the area of Systems Neuroscience. Lectures covered sensorimotor systems, associative systems, cognition, cortical integration, and computational neuroscience. This course offered a unique teaching opportunity for postdoctoral associates in my lab to get experience guiding lectures and interacting with students.

Neuroscience Journal Club (NEU 600): This course covers 8-12 scientific papers in the area of systems neuroscience and brain-machine interfaces for the students to discuss and analyze. In this course, students present papers and are responsible for answering questions and discussing with the faculty.

Medical Resident and Student Education

This course includes synergistic research partnerships with clinicians to provide practical laboratory experience for medical residents and students who are seeking to add research components to their careers in medicine. It includes small study sections in which students explore and understand the techniques of how engineers affect medicine, and technology by developing design and analysis skills. A second goal is to offer training to overcome many of the communication barriers of medical and engineering interaction.

Medical students/residents who have participated in this program

- Daniel Perez – M.D., Ph.D. student (2011-2012), "Neural correlates of Tourette Syndrome assessed through human Deep Brain Stimulation.
- Muhammad M. Abd-El-Barr M.D., Ph.D. Neurosurgery 2011-2012 Project Proposal, "Human Neuronal Responses in Relation to Reward and Motor Tasks", Mentors: Justin C. Sanchez, Ph.D., Michael S. Okun, M.D., Kelly Foote, M.D.

- Nurosurgery 2011 Best Presentation Award "Utilization of Neurophysiological Data for Movement and Neuropsychiatric Diseases"

- David Wang (Medical Student) – (2006 – 2007) – Correlating DBS electrophysiology with motor exams

Medical Faculty

- Richard McNeer, Assistant Professor, Department of Anesthesiology, University of Miami, mentor NIH K08 to study neural activation of anesthetic agents in animals and humans.

Undergraduate Research Opportunities

One focus of my work is to promote undergraduate achievement in research and continued higher education. The interdisciplinary nature of the research topic proposed offers opportunities for undergraduate students to gain experience in a wet lab environment and with data analysis. Moreover, this program has the potential for teaching students the "realities" of developing translational medical devices. The knowledge and experience has been used to encourage undergraduate students to pursue higher graduate degrees (PhD) or careers in medicine.

Undergraduate students working under my supervision

- Katherine Brisson (Undergraduate, Neuroscience) – (11/12 – 3/13) – Combined BCI and Rehabilitation for Spinal Cord Injury
- Laura MacKinnon (Undergraduate, Biomedical Engineering) – (5/12 – 8/12) – Control of a biomimetic robotic hand.
- Richard Morgan (Undergraduate, Biopsychology) – (5/12 – 8/12) – Design of a motor control task for rodent BMI experiments.
- Kevin Liu (Undergraduate, Biomedical Engineering) – (5/12 – 6/13) – 3-D arm motion tracking for BMI reaching tasks.
- Jayson Garmizo (Undergraduate, Biomedical Engineering) – (5/12 – 8/12) – Design of experimental control for primate BMI experiments.
- Christina Brea (Undergraduate, Biomedical Engineering) – (5/11 – 6/13) – Analysis of biotic failure mechanisms of chronic microelectrode arrays.
- Lara Carter (Undergraduate, Biomedical Engineering) – (5/11 – 1/12) – Analysis of abiotic failure mechanisms of chronic microelectrode arrays.
- Christina Marie Baker (Undergraduate, Vanderbilt Biomedical Engineering (6/11-9/11) - 2011 Summer Research Program at the Miami Project to Cure Paralysis – Development of a Wireless BCI system for Rehabilitation in Spinal Cord Injury.
- Francisco Halili (Undergraduate, Biomedical Engineering) – (2/11 – 6/13) – Development of a robotic arm for brain-machine interface control
- Matthew Furtney (Undergraduate, Biomedical Engineering) – (2/11 – 6/13) – Development of a motion tracker for brain-machine interface control
- Hernan Gonzalez (Undergraduate, Biomedical Engineering) – (12/10 – 6/13) – Analysis of biotic and abiotic properties of microelectrodes for BMI. Hernan's abstract was selected as a top presentation for the 2011 UM Undergraduate Competition for Research, Creativity, and Innovation Forum
- Shijia Geng (Undergraduate, Neuroscience) – (12/10 – 6/11) – Analysis of motor and reward signals for BMIs
- Nicholas Pavlovsky (Undergraduate, Biological Engineering) – (5/09 – 6/13) – Analysis of spike recordings from an animal model of temporal lobe epilepsy

- Krystina Subieta (Undergraduate, Mechanical Engineering) – (10/08 – 1/11) – Video analysis for Brain-Machine Interfaces. Under my supervision, Krystina was awarded a summer research fellowship at Rice University.
- Scott Amerman (undergrad Physics – 5/08 – 12/08) – Design of a 64 channel neural recording system.
- Geoffrey Kvasnok (undergrad Chemical Engineering – 10/07 – 5/08) – Design and testing of a stereotaxic neurosurgery drive arm for microelectrode arrays.
- Alexandra Issa (undergrad BME, Duke University, 06/06 – 08/06), Electrophysiological analysis and identification of human seizure onset zones (The summer research conducted under my supervision was used to gain acceptance to the Pratt Engineering Undergraduate Fellows Program at Duke University).
- Matthew Ordonez (undergrad ECE) – (3/05 – 3/06) – Flexible Neural Probes for Brain Machine Interfaces.
- Jason Pukala (undergrad ECE) – (3/04 – 12/04) – LPC Classification of DBS Neuronal Recordings (the student received highest honors from the Undergraduate Research Scholars Program for his work in Deep Brain Stimulation signal processing and published a paper on the work).

UM BME Senior Design Projects

- Jesse Bryant and Cameron Duckett (2012) - EEG-Controlled LED: A Step Towards Creating a BCI Wheelchair

Visiting International Students

- Claire Poulard (MS Student – University of Paris Descartes) - (3/13-6/13) – Testbed for a brain controlled FES system.

THESIS AND DISSERATION ADVISING / POST-DOCTORAL STUDENT SUPERVISION

Role	Student	Research Topic	Complete Date
Post-Doctoral Associates	Eric Pohlmeyer	Symbiotic Brain-Machine Interfaces	2012
	Abhishek Prasad	Characterization of Biotic and Abiotic Failure Mechanisms of Neural Electrodes	2012
	Kun-Ze Lee In 2010, Kun-Ze received a fellowship award from the Paralyzed Veterans of America. Total funding was $100,000 for two years.	Training Novel Host-Graft Circuits to Enhance Spinal Cord Repair	2011
	Milap Sandhu	Training Novel Host-Graft Circuits to Enhance Spinal Cord Repair	2013
	Babak Mahmoudi	Hebbian Reinforcement Learning for Neural Decoding	2013
Chair, 8 Ph.D. Committees	Katie Gant In 2013, Katie received an NSF sponsored fellowship for the Science Made Sensible program. (http://smsmiami.org/sms/)	Responsive NeuroRehabilitation	2016

	Noeline Prins	Self-Calibrating Brain-Machine Interfaces	2015
	Scott Roset	EEG BCI using Reinforcement Learning	2014
	Nicholas Maling In 2010, Nicholas recieved a Clinical Translational Science Institute training grant which covers his stipend ($20,976), tuition, and travel ($1,000) per year.	Neurophysology of Toruette's Syndrome	2014
	Babak Mahmoudi In 2009, Babak received a research fellowship to attend the Thirteenth International Conference on Cognitive and Neural Systems (ICCNS) at Boston University. Babak was also a finalist in the 2009 EMBS Student Paper Competition.	Goal-Directed Brain-Machine Interfaces	2010
	Jack DiGiovanna (Co-Chair)	Reinforcement Learning for Neuroprosthetics	2008
	Aysegul Gunduz (Co-Chair)	Human ECoG Brain-Machine Interfaces	2008
	Viswanath Sankar	Abiotic design of microelectrode arrays.	2014
Member, 14 Ph.D. Committees	An Wu	Coding mechanism of the geniculate ganglion by multi-neuronal calcium imaging	2014
	Rong-Wen Tain	Modeling Brain Compliance	2011
	Jonathon Toft-Nielsen	Acquisition and Analysis of High Rate Electroretinograms	2011
	Prapaporn Rattanatamrong	Real-Time Scheduling of Ensemble Systems	2011
	Jie Xu	A LowPower Bioamplifier for Brain-Machine Interfaces	2011
	Il Park	Interpretation of Spike Trains using Kernel Methods	2010
	Erin Patrick	MEMS Based Microelectrode Arrays	2010
	Adam McLeod	Disposable Walking Robots	2010
	Shalom Darmanjian	Generative Neural Clustering	2009
	Antonio R. C. Paiva	Reproducing Kernel Hilbert Spaces for Neural Analysis	2008
	Yiwen Wang	Stochastic Modeling for Brain-Machine Interfaces	2008
	Christy Rogers	Multiscale Spike Sorting in Analog Hardware	2007
	Yuan Li	Pulse Based Amplifier for Neural Implants	2006

	Shijia Geng	Analysis of Neural Representations for Task Switching in Brain Machine Interface	2014
Member, 1 M.S. Committee	Girish Singhal	Towards Clinically Viable Neuroprosthesis	2009

SERVICE

University Committee and Administrative Responsibilities:

2012-2013 Member of UM Engineering College Council

2012 Miami Project to Cure Paralysis Summer Student Poster Competition Judge

2011 UM Representative for the Society for the Advancement of Chicanos and Native Americans in Science, San Jose, CA

2011-2013 Department of Biomedical Engineering Industrial Advisory Committee Chair

2011-2013 Department of Biomedical Engineering Awards Committee Chair

2011 Interviewer, University of Miami Singer Scholars

2011-2013 Member UM IACUC (Institutional Animal Care and Use Committee)

2010-2013 Department of Biomedical Engineering Undergraduate Research Coordinator

2006-2010 Advisory Board Member, Data Mining, Systems Analysis and Optimization in Neuroscience, University of Florida, College of Engineering and McKnight Brain Institute

2005-2010 Ad Hoc Interviewer, Interdisciplinary Program in Biomedical Sciences, University of Florida

COMMUNITY ACTIVITIES

Service to Schools

2010-2011 Mentor 9th grade class at the Bergen County Academies Internet Science and Technology Fair.

2007-2010 School Advisory Committee – Terwilliger Elementary, Gainesville, FL

2006 Terwilliger Elementary: Careers in Science Day, Gainesville, FL