

Sean M. Montgomery

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Summary

I am a highly motivated, goal oriented problem solver with a broad skill set in electronics, programming, data analysis and visualization methods. While finishing my Ph.D. in Neuroscience studying neuronal oscillations, I used my free time combining my background in biology with an interest in technology to create wearable biofeedback fashion accessories including a shirt that lights up with the wearer's heart beat, a wristband that displays the wearer's emotional arousal, and a hat that detects and displays changes in the wearer's brain activity. These works are now available in select commercial venues and have been displayed in several galleries and museums around the world. Looking forward, I am interested to find/create opportunities at the interface of technology, science, art and entrepreneurship, with a special interest toward social enterprise.

Technical Skills

- **Electronics/Hardware**
Analog and digital circuit design, analysis, and implementation; microcontrollers; computer-hardware interface; building computers
- **Programming**
Matlab; Labview; C; C++; Java; Bash; Perl; HTML; PHP; XML; Javascript
- **Data Analysis**
Dimension reduction methods (PCA, SVD, ICA, etc.); cluster analysis; current-source density; spectral analysis (filters, Fourier, wavelet); multi-dimensional statistics (GLM, parametric, non-parametric, bootstrap); high-dimensional visualization
- **Platforms**
Windows; Red Hat; SUSE; NFS; Samba; Apache
- **Software**
MPLAB; HI-TIDE; 5spice; Eagle; NoMachine NX; VNC; Illustrator; PhotoShop; Premiere; Corel Draw; Word; Excel; PowerPoint
- **Other**
Machining; fabrication; carpentry; cognitive and behavioral analysis; *in vivo* electrophysiology; stereotaxic surgery; IP injections; histology; *in situ* hybridization

Education

- Rutgers University: Ph.D., Neuroscience
Newark, NJ GPA 3.985 2009
- Reed College: B.A., Psychology
Portland, OR GPA 3.32 1999

Awards and Fellowships

- Integrative Neurosci Minisymposium - Best Oral Presentation 2005
- Integrative Neurosci Minisymposium - Best Poster Presentation 2004
- Reinvest in Rutgers Competitive Academic Scholarship 2001-2003
- The Neurosciences Graduate Student of the Year Award 2001-2002
- NDSEG Graduate Research Fellowship finalist 2001
- NSF Graduate Research Fellowship honorable mention 2001
- Reed College President's Commendation for Academic Excellence 1999
- Center for Neuroscience at University of Pittsburgh Fellowship 6/98 to 8/98

Leadership Roles

- Integrative Neuroscience Program Student Body President 2002-2007
- Integrative Neuroscience Student-Postdoc Research Social Coordinator 2002-2007

Experience

- **Vital Threads Biofeedback Apparel** 2007-2009
I designed and developed a collection of biofeedback clothing that measures and displays the wearer's personal biological signals in order to open fashion and design to dynamic new forms of self awareness, personal expression and interpersonal communication. Three works include a shirt that lights up with the wearer's heartbeat (EKG), a wristband that displays emotional responses (GSR) and a hat that displays changes in brain activity (EEG) using embedded analog and digital circuitry. Building on my background in biology, I taught myself the necessary technical skills to create these works that have now been displayed in several venues around the world as works of new media art and are available in select commercial venues.
- **Ph.D. Dissertation - The Functional Anatomy of Hippocampal Theta and Gamma Oscillations** 2001-2009
I studied how networks of neurons in different brain areas are synchronized by oscillatory activation patterns during encoding and retrieval of memories and during REM sleep. My findings were consolidated into numerous publications and generally gave important new insights into the manner by which theta and gamma oscillations coordinate specific regions of the hippocampal formation to serve mnemonic functions. Completion of this project entailed the development and implementation of new hardware, data management systems, multi-dimensional analysis and visualization methods.
- **Research Assistantship in the Eichenbaum Laboratory at Boston University** 1999-2001
I was involved with several projects in the Eichenbaum lab, including one project working closely with two post-docs to submit a successfully funded NIH Small Business Innovation Research (SBIR) grant to develop a 64-channel recording system to amplify and digitize neuronal signals.

Teaching Experience

- **TEI 2010 Studio - Measuring Biological Signals: Concepts and Practice** 2010
I led a day long workshop in the Tangible, Embedded and Embodied Interactions conference held at the MIT Media Lab covering basic principles and practical considerations in measuring different biological signals for implementation in wearable devices, art, industrial applications, and more.
- **Teaching Assistantships** 2003-2004
I was a TA for three different undergraduate and graduate level courses in which I prepared and presented lectures, provided students with one on one tutoring, facilitated in-class discussions and graded exams and homework assignments.

Art Exhibitions

- **Vital Threads Biofeedback Apparel**
 - The National Taiwan Museum of Fine Arts in Taichung, Taiwan. Freeze! Exhibit. <http://freeze.ntmofa.gov.tw/> 7/09 to 9/09
 - Fish With Braids Gallery, Jersey City, New Jersey, USA. 10/08
 - The Last HOPE conference, Manhattan, New York, USA. 7/08

Publications

Journal Articles

- Montgomery SM, Betancur M, Buzsaki G (2009). Behavior-dependent coordination of multiple theta dipoles in the hippocampus. *J Neurosci* 29(5): 1381-1394.
- Montgomery SM, Sirota A, Buzsaki G (2008). Theta and gamma coordination of hippocampal networks during waking and REM sleep. *J Neurosci* 28(26): 6731-6741.
- Montgomery SM, Buzsáki G. (2007). Gamma oscillations dynamically couple hippocampal CA3 and CA1 regions during memory task performance. *Proc Natl Acad Sci* 104(36):14495-500.
- Sirota A, Montgomery SM, Fujisawa S, Isomura Y, Zugaro M, Buzsáki G (2007). Entrainment of neocortical neurons and gamma oscillations by the hippocampal theta rhythm. *Neuron* 60(4): 683-697.
- Anastassiou C, Montgomery S, Barahona M, Buzsaki G, Koch K. The effect of spatially inhomogeneous extracellular electric fields on neurons. *JNeurosci* (In Press).
- Robbe D, Montgomery SM, Thome A, Rueda-Orozco PE, McNaughton BL, Buzsaki G. (2006). Cannabinoids reveal importance of spike timing coordination in hippocampal function. *Nat Neurosci* 12:1526-33.
- Isomura Y, Sirota A, Ozen S, Montgomery S, Mizuseki K, Henze DA, Buzsáki G. (2006). Integration and segregation of activity in entorhinal-hippocampal subregions by neocortical slow oscillations. *Neuron* 52(5):871-82.

Abstracts

- Sean M. Montgomery (2010). Measuring Biological Signals: Concepts and Practice. Tangible, Embedded, and Embodied Interaction Annual Conference.
- S. M. Montgomery, A. M. Sirota, G. Buzsaki (2007). Hippocampal CA3-CA1 theta phase shift during memory retrieval. Society for Neuroscience Annual Meeting.
- K. Mizuseki, A. Sirota, S. M. Montgomery, G. Buzsaki (2007). Theta coordination of the hippocampus and entorhinal cortex during waking and REM sleep. Society for Neuroscience Annual Meeting.
- S. M. Montgomery, G. Buzsaki; (2006). Differential synchronization of hippocampal networks during REM sleep versus active waking. Society for Neuroscience Annual Meeting.
- S. Royer, A. Sirota, S. Montgomery, G. Buzsaki; (2006). Spatial and behavioral correlates of neuronal activity in the ventral hippocampus and lateral entorhinal cortex. Society for Neuroscience Annual Meeting.
- D. M. Robbe, P. Rueda-Orozco, C. Geisler, S. M. Montgomery, G. Buzsaki; (2006). Effects of cannabinoids on hippocampal network activity in rats engaged in a delayed spatial alternation task. Society for Neuroscience Annual Meeting.
- S.M.Montgomery; M.Betancur; G.Buzsaki (2005). Anatomically Specific Coupling Of Hippocampal Theta And Gamma Oscillations In A Working Memory Task. Society for Neuroscience Annual Meeting.
- D.Robbe; S.M.Montgomery; G.Buzsaki (2005). Cannabinoids Destroy Cell Assembly Coordination In The Hippocampus. Society for Neuroscience Annual Meeting.
- K.Diba; S.M.Montgomery; K.D.Harris; G.Buzsaki (2005). Identification Of Recording Site Irregularities In Silicon Probes *In Vivo*. Society for Neuroscience Annual Meeting.
- A.M.Sirota; S.M.Montgomery; M.B.Zugaro; L.Monconduit; D.L.Buhl; G.Buzsaki (2005). Neocortical-Hippocampal Interactions Through And Oscillations. Society for Neuroscience Annual Meeting.
- S.M.Montgomery; K.D.Harris; H.Hirase; M.Betancur; A.M.Sirota; G.Buzsaki (2004). Task-related changes in the anatomical distribution of hippocampal theta oscillations. Society for Neuroscience Annual Meeting.
- Montgomery, SM, Calhoun, ME, Fletcher, BR, Rapp, PR (2003). Arc mRNA expression is induced at similar levels by performance of a well-learned task and explorations of a novel environment. Society for Neuroscience Annual Meeting.
- Buhl, DL, Morozon, A, Montgomery, SM, Harris, K, Kandel, E, Buzsaki, G (2002). Network patterns in the hippocampus of the HCN1 KO mouse. Society for Neuroscience Annual Meeting.

- Rhodes, DL & Montgomery, S (2000). Attention-centered spatial asymmetries. Cognitive Neuroscience Annual Meeting.

Letters of recommendation available upon request.