

## Sean M. Montgomery

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### Summary

I have 13 years of experience in scientific research, programming, and electrical engineering. I excel at using multidisciplinary approaches and team management to solve challenging problems. I am generally interested to find/create opportunities at the interface of technology, science, art and entrepreneurship with a special interest toward social enterprise.

### Specialities

Software; hardware; data analysis; biometrics

### Technical Skills

- **Electronics/Hardware**  
Analog and digital circuit design, analysis, and implementation; microcontrollers; firmware development; computer-hardware interface; building computers
- **Programming**  
Matlab; Labview; C; C++; Java; Android; OpenCV, OpenSceneGraph; Bash; Perl; HTML; ASP.NET; PHP; XML; Javascript
- **Data Analysis**  
Stereoscopic image processing and 3D surface reconstruction; 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; Eclipse; MSVS; HI-TIDE; 5spice; Eagle; SVN; Git; 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

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|--|-----------|------|
| • <b>Rutgers University:</b> Ph.D., Neuroscience<br>Newark, NJ | GPA 3.985 | 2009 |
| • <b>Reed College:</b> B.A., Psychology<br>Portland, OR        | GPA 3.32  | 1999 |

### Awards and Fellowships

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|--|--------------|
| • The Neurosciences Graduate Student of the Year Award           | 2001-2002    |
| • Reed College President's Commendation for Academic Excellence  | 1999         |
| • Center for Neuroscience at University of Pittsburgh Fellowship | 6/98 to 8/98 |

## Experience

<ul style="list-style-type: none"> <li>• <b>Senior Engineer at SensorStar Inc.</b></li> </ul>	<b>2010-Present</b>
Software engineering, data processing algorithms, hardware design and testing, firmware development.	
<ul style="list-style-type: none"> <li>• <b>Vital Threads Biofeedback Apparel</b></li> </ul>	<b>2007-Present</b>
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. <a href="http://produceconsumerobot.com/vitalthreads/">http://produceconsumerobot.com/vitalthreads/</a>	
<ul style="list-style-type: none"> <li>• <b>Ph.D. Dissertation - The Functional Anatomy of Hippocampal Theta and Gamma Oscillations</b></li> </ul>	<b>2001-2009</b>
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.	
<ul style="list-style-type: none"> <li>• <b>Research Assistantship in the Eichenbaum Laboratory at Boston University</b></li> </ul>	<b>1999-2001</b>
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.	

## Art Exhibitions

### Emergence

<a href="http://produceconsumerobot.com/emergence/">http://produceconsumerobot.com/emergence/</a>	
• Center for Life, Newcastle, England	<b>3/11</b>
• Open House Gallery, NoLita, New York, NY, USA	<b>11/10</b>

### Vital Threads Biofeedback Apparel

<a href="http://produceconsumerobot.com/vitalthreads/">http://produceconsumerobot.com/vitalthreads/</a>	
• Center for Life, Newcastle, England	<b>3/11</b>
• American Natural History Museum, New York, NY	<b>2/11</b>
• The National Taiwan Museum of Fine Arts in Taichung, Taiwan. Freeze! Exhibit. <a href="http://freeze.ntmofa.gov.tw/">http://freeze.ntmofa.gov.tw/</a>	<b>7/09 to 9/09</b>
• Fish With Braids Gallery, Jersey City, New Jersey, USA.	<b>10/08</b>
• The Last HOPE conference, Manhattan, New York, USA.	<b>7/08</b>
• Dorkbot NYC, Manhattan, New York, USA. May 7, 2008.	<b>5/08</b>

## Talks

<ul style="list-style-type: none"> <li>• <b>Neuroaesthetics: What is EEG and what can we do with it</b></li> </ul>	<b>2010</b>
Ontario College of Art and Design, Toronto, ON, Canada	
<ul style="list-style-type: none"> <li>• <b>Biofeedback Fashion and Design: New Forms of Expression and Communication at the Interface of Biology and Technology</b></li> </ul>	<b>2009</b>
The National Taiwan Museum of Fine Arts in Taichung, Taiwan	

<ul style="list-style-type: none"> <li>• <b>Vital Threads Biofeedback Apparel</b> Dorkbot, New York, NY, USA</li> </ul>	<b>2008</b>
<ul style="list-style-type: none"> <li>• <b>Gamma Oscillations Couple Hippocampal Networks During Performance of a Memory Task</b> Temporal Dynamics of Learning and Memory Meeting, UCSD, San Diego, CA, USA</li> </ul>	<b>2007</b>
<b>Teaching</b>	
<ul style="list-style-type: none"> <li>• <b>ITP Camp, NYU, New York, NY</b> Measuring Biological Signals for Art and Business (and anything in between) <a href="http://produceconsumerobot.com/ITPcamp2011/">http://produceconsumerobot.com/ITPcamp2011/</a></li> </ul>	<b>2011</b>
<ul style="list-style-type: none"> <li>• <b>ITP Camp, NYU, New York, NY</b> Measuring Biological Signals for Art and Business (and anything in between) <a href="http://produceconsumerobot.com/ITPcamp2010/">http://produceconsumerobot.com/ITPcamp2010/</a></li> </ul>	<b>2010</b>
<ul style="list-style-type: none"> <li>• <b>TEI Studio, MIT Media Lab, Cambridge, MA</b> Measuring Biological Signals: Concepts and Practice <a href="http://produceconsumerobot.com/TEI2010/">http://produceconsumerobot.com/TEI2010/</a></li> </ul>	<b>2010</b>
<ul style="list-style-type: none"> <li>• <b>Teaching Assistantships, Rutgers University</b></li> </ul>	<b>2003-2004</b>
<b>Publications</b>	
<b>Journal Articles</b>	
<ul style="list-style-type: none"> <li>• <b>Sean M. Montgomery</b> and Ira M. Laefsky (2011) Biosensing: Track your body's signals and brain waves and use them to control things. <i>Make Magazine</i> 26:104-111.</li> </ul>	
<ul style="list-style-type: none"> <li>• Sullivan D, Csicsvari J, Mizuseki K, <b>Montgomery S</b>, Diba K, Buzsáki G. (2011) Relationships between Hippocampal Sharp Waves, Ripples, and Fast Gamma Oscillation: Influence of Dentate and Entorhinal Cortical Activity. <i>J Neurosci.</i> 31(23):8605-16.</li> </ul>	
<ul style="list-style-type: none"> <li>• Anastassiou C, <b>Montgomery SM</b>, Barahona M, Buzsaki G, Koch K. (2010) The effect of spatially inhomogeneous extracellular electric fields on neurons. <i>JNeurosci</i> 30(5):1925-36.</li> </ul>	
<ul style="list-style-type: none"> <li>• Gyorgy Buzsaki and <b>Sean M. Montgomery</b> (2009) REM Dreams. <i>Frontiers in Neuroscience</i> 3(3): 440-441.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Montgomery SM</b>, Betancur M, Buzsaki G (2009). Behavior-dependent coordination of multiple theta dipoles in the hippocampus. <i>J Neurosci</i> 29(5): 1381-1394.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Montgomery SM</b>, Sirota A, Buzsaki G (2008). Theta and gamma coordination of hippocampal networks during waking and REM sleep. <i>J Neurosci</i> 28(26): 6731-6741.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>Montgomery SM</b>, Buzsáki G. (2007). Gamma oscillations dynamically couple hippocampal CA3 and CA1 regions during memory task performance. <i>Proc Natl Acad Sci</i> 104(36):14495-500.</li> </ul>	
<ul style="list-style-type: none"> <li>• Sirota A, <b>Montgomery SM</b>, Fujisawa S, Isomura Y, Zugaro M, Buzsáki G (2007). Entrainment of neocortical neurons and gamma oscillations by the hippocampal theta rhythm. <i>Neuron</i> 60(4): 683-697.</li> </ul>	
<ul style="list-style-type: none"> <li>• Robbe D, <b>Montgomery SM</b>, Thome A, Rueda-Orozco PE, McNaughton BL, Buzsaki G. (2006). Cannabinoids reveal importance of spike timing coordination in hippocampal function. <i>Nat Neurosci</i> 12:1526-33.</li> </ul>	
<ul style="list-style-type: none"> <li>• Isomura Y, Sirota A, Ozen S, <b>Montgomery S</b>, Mizuseki K, Henze DA, Buzsáki G. (2006). Integration and segregation of activity in entorhinal-hippocampal subregions by neocortical slow oscillations. <i>Neuron</i> 52(5):871-82.</li> </ul>	
<b>Abstracts</b>	
<ul style="list-style-type: none"> <li>• <b>Sean M. Montgomery</b> (2010). Measuring Biological Signals: Concepts and Practice. Tangible, Embedded, and Embodied Interaction Annual Conference.</li> </ul>	
<ul style="list-style-type: none"> <li>• <b>S. M. Montgomery</b>, A. M. Sirota, G. Buzsaki (2007). Hippocampal CA3-CA1 theta phase shift during memory retrieval. Society for Neuroscience Annual Meeting.</li> </ul>	
<ul style="list-style-type: none"> <li>• K. Mizuseki, A. Sirota, <b>S. M. Montgomery</b>, G. Buzsaki (2007). Theta coordination of the hippocampus and entorhinal cortex during waking and REM sleep. Society for Neuroscience Annual Meeting</li> </ul>	

- 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.

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