MULUGETA SEMEWORK ABEBE, PH.D. **ASSOCIATE RESEARCH SCIENTIST, COLUMBIA UNIVERSITY**
LinkedIn: https://www.linkedin.com/in/mulugeta-semework-4b218985

PROFILE

- Neuroscience PhD with 12 years of user interface programming, experimental design, data analysis and experiment coding, and neurosurgery experience
- Published several peer-reviewed scientific papers
- Won the prestigious NARSAD Young Investigator Award
- Presented in national and international conferences
- Proficient in science communication with both lay and expert audiences

RELEVANT EXPERIENCES

Columbia University Medical Center, New York **Associate Research Scientist** **2011-current**

- Applied Granger causality and Akaike Information Criteria methods, wrote a Graphic User Interface (GUI) and algorithm/code which get real-time financial market performances for more than 5000 symbols and give future prospect predictions in just a few minutes, with associated accuracy of close to 90%
- Thoroughly mined more than 1000 old neural data files, recorded from more than 500 single neurons, and performed signal and statistical analysis to improve physiologically responding unit count by 30%
- Invented a unique imaging compound, collected and analyzed empirical data and communicated the results (in use by our & other laboratories, patent applied by Columbia University)
- Spear-headed interdepartmental project to design a primate RF coil, collected and analyzed MRI images, improving signal quality by about 25%, decreasing scan time and expense by 25% and helping other researchers at each of their procedures, and ultimately having all of the principal investigators in our center to use the suite exclusively.

SUNY Downstate Medical Center, New York **Doctoral dissertation** **2004-2011**

- Majored in brain-machine interfacing which required a lot of out-of-the box thinking and communication skills to solve technical problems and share the science with non/academic audiences
- Took classes on robotics and computational neuroscience, such as neural networks, and implemented lessons on all levels of laboratory experiments and associated data
- Collected about 5 GB of neural, eye and hand movement data daily, analyzed and submitted weekly reports that boiled the findings down into just a few pages, to help DARPA (funding agency) interpret our results
- Utilized the data to create a web-cam based eye-tracking and, consequently, eye-controlled robotic system used by primates to get rewards when they played computer games
- Used simultaneous microstimulation and recording neural data to study causal relationships between the cortex and the thalamus resulting in a peer-reviewed publication
- Developed, analyzed imaging data, documented and published a method for MRI 3D localization of brain structures which improved our surgery precision by almost two-fold
- Wrote a GUI for real-time, spike-triggered brain and tactile stimulation which was used by several researchers

PROFESSIONAL AND RESEARCH EXPERIENCE

Columbia University Medical Center, New York

Postdoctoral scholar ***2011-current***

- Developed and documented specific procedures for laboratory routines and brain surgeries
- Invented a unique imaging compound (in use by our & other labs, patent applied by Columbia U.)
- Mentored undergraduate and graduate students in neuroscience experiments, programming, and science writing
- Served as seminar chair for Gordon Eye Movement conferences

SUNY Downstate Medical Center, New York

Doctoral dissertation ***2004-2011***

- Taught a full-semester course at the Arthur Ashe Health Science Academy: Genetics & Human Reproductive System, a college-preparation course for high-achieving senior high-school students
- Developed, documented and published a method for MRI 3D localization of brain structures
- Coded a Graphic User Interface for brain and tactile stimulation which was used by several researchers
- Designed and constructed primate hand and shoulder wearable EMG leads & straps used by the whole lab

Ben-Gurion University, Israel

M.Sc. thesis research ***1995-1996***

- Learned Hebrew in just a few months and communicated with ease
- Quickly learned and performed physiology and biochemistry experiments

Alemaya University, Ethiopia

Lecturer ***1992-1995***

- Attended MASHAV course (Israel, provided by Israel's Ministry of Foreign Affairs), then gathered, organized and bound all materials and archived in the reference section of the Alemaya university library
- Taught undergraduate students: full-semester courses in plant physiology and pathology

Independent and freelance work ***2011-current***

- Freelance medical writing for Concentric Health Experience
- Editor: Columbia U. postdoc newsletter, designed layout and graphics, covers, edited sections including NY City and nation-wide science/art/social events, interviewed department heads & wrote highlight pieces

EDUCATION

Ph.D. in Neural Science and Behavior, SUNY Downstate Med. Center, NY ***2011***
Brain-machine interface (BMI)/Somatosensory neuroprosthesis

M.Sc. in Neurobiology, Honors, Georgia State University, GA. ***2000***

B.Sc. in Agronomy/Physiology, Honors, Alemaya University, Ethiopia ***1992***

HONORS

Bachelor of Science with Honors in Agronomy/Physiology, ***1992***
Alemaya University, Dire Dawa, Ethiopia

Master of Science with Honors in Plant Physiology/Biochemistry, ***1996***
Alemaya University (Ethiopia) and Ben-Gurion University (Israel)

SKILLS

Programming, data analysis, surgery and project management

- Proficient in Matlab, Windows & xPC Target, working knowledge of programing in Python and C++
- Skilled in all the major Microsoft office suits, Adobe Creative Cloud, music recording and editing software such as Cubase and NCH, graphics software such as Rhinoceros
- Over 12 years of experience in animal procedures including monkey and rat cortical and thalamic electrode array implantation surgeries, and monkey behavioral training.
- Experience in project design and management, hypothesis testing, causal and statistical analysis

CONTRIBUTIONS TO SCIENCE

1. My Ph.D. (Brain Machine Interface, Somatosensory Neuroprosthesis, at SUNY Downstate Medical Center, Brooklyn, NY) research focused on finding ways to send feedback from brain machine interfacing (BMI) devices to the brain by using electrical stimulation to replicate natural brain activity. I found that compared to the cortex, the ventral posterolateral (VPL) thalamus could be an equal or better candidate for creating natural sensations via somatosensory neuroprosthesis. I also used Linear Granger causality (LGC) analysis to investigate information flow between the cortex and the VPL thalamus and discovered stimulus-dependent dynamic interactions. These studies are important to understand neural processes that go awry in illnesses and interrupted neural pathways.

    a. Chhatbar, P., vonKraus, L., **Semework, M.,** and Francis, J. T. (2010). *A Bio-friendly and Economical Technique for Chronic Implantation of Multiple Microelectrode Arrays*. J Neurosci Methods. 2010 May 15;188(2):187-94.
    b. **Semework, M.** and M. DiStasio. (2014). *Short-term dynamics of causal information transfer in thalamocortical networks during natural inputs and microstimulation for somatosensory neuroprosthesis.* Front Neuroeng 7: 36.
    c. Song W, **Semework M.** (2015). *Tactile representation in somatosensory thalamus (VPL) and cortex (S1) of awake primate and the plasticity induced by VPL neuroprosthetic stimulation. Brain Res.* Sep 5. 2015. pii: S0006-8993(15)00697-6. doi: 10.1016/j.brainres.2015.08.046. PMID: 26348987

2. Another very important consideration in any scientific endeavor is how ethical issues can play significant roles. I have thus investigated and published on ethical considerations of application of microsimulation for critical brain structures such as the thalamus. Moreover, I strongly believe that, just as the general public, and research animals, the psychological well-being of researchers and medical professionals is an integral part of human progress.

    a. **Semework, M.,** Subrata, S. (2011). *Major safety and ethical concerns in brain stimulation*. Ethics in biology, engineering, & medicine 2(4). 305-316.
    b. **Semework, M.** (Submitted). (2015). "Jerk, but Genius!": Humane treatment of humans in research and medicine. AJOB Neuroscience, 2015.

3. In addition to my scientific focus of understanding spatial memory (environmental memory) in LIP (see first publication below) and parahippocampus (PH), my current work involves a very exciting mix of scientific procedures and technical approaches which constantly help in improving my skills and contributions to the scientific and patient community.

a. **Semework, M.,** S. C. Steenrod, Goldberg, M. E. (In submission). (2016). *A neural substrate for environmental memory in lateral intraparietal area (LIP)*. JNS.
b. Patent applied by Columbia Tech Ventures (Reference: IR CU13187). (2015). *Marker paste for medical and industrial imaging (MRI, CT, X-Ray) and visualization of materials and external body surfaces.*
c. **Semework M.** (2015). *A Customizable Multimodality Imaging Compound That Relates External Landmarks to Internal Structures.* J Nucl Med Technol. 2015 Dec;43(4):267-74. doi: 10.2967/jnmt.115.162404.

PUBLISHED REVIEW PAPER

Semework, M. (2015). *Microstimulation: techniques, basic principles and somatosensory neuroprosthesis approaches.* Critical Reviews in Biomedical Engineering. 2015;43(1):61-95. PMID: 26351023

FORMAL TEACHING

The Arthur Ashe Institute of my graduate school (SUNY Downstate Med. Center), The Human Reproductive System 2008

OTHER MEETINGS AND PROFESSIONAL DEVELOPMENT COURSES

- ***European Summer School Visual Neuroscience*** *University of Giessen, Germany* ***2012***
- ***Center for Visual Science symposium*** *Rochester, NY June* ***2016***
- ***Certification classes and workshops through Columbia*** ***2015-2106***

  - ***Teaching 2.0.*** *What you need to know to be a successful teacher* **Spring 2016**
  - **Transitioning to Research Independence course** **7/2016**
  - **The Faculty Application and Interviewing Process** **9/2016**
  - **STEM Outreach Colloquium** **4/2016**
  - **Graduate Level Career Fair** **9/2015**
  - **Columbia University Postdoc Symposium**, Poster presenter **9/ 2016**
  - **Targeted resume workshop** **10/2016**
  - ***NIH Grants Workshops for Junior Faculty and Postdocs*** ***10/ 2016***
  - ***NIH Rigor and Reproducibility in Research***

MENTORSHIP

Undergraduate student volunteer	M.Sc. student volunteers	Medical Doctor volunteer
Sameer Sabharwal-Siddiqi (2015-2016)	Yudi Ortega (2013-2015) David Castellano (2015-2016)	Makda Bisrat, MD (2016)

SELECTED LEADERSHIP EXPERIENCE

- Formally mentored one undergraduate, two graduate students and an MD at Columbia University
- Successfully created calm and constructive class room environments for high school & undergraduate students
- Liaised inter-laboratory collaborations
- Served as Gordon Research Seminars session chair

INVITED PARTICIPATIONS

- Chair, Gordon Research Seminars, Bentley College, Boston, MA — **7/ *2015***
- Poster competition Judge: Columbia University Postdoc Symposium — **8/2015**
- Lead discussions and served as a rapporteur at the Department of Defense (DOD) workshop: *Shifting the Paradigms in Neuroscience: What could be possible in 2025?* — ***3/ 2012***

OTHER PROFESSIONAL MEMBERSHIPS AND POSITIONS

Member, Society for Neuroscience	**2014 -**
Member, Columbia University Medical Center Post-doc Society	**06/2014 -**
Member, New York City-wide Post-doc council	**07/2014 -**
Editor, Columbia University Post-doc newsletter	**07/2015 -**
Journal Reviewer, Critical Reviews in Neuroscience	**2015 -**
Columbia Postdoc Peer Mentoring Group	**2016 -**

FUNDING

CURRENT

3 R01 EY014978-06 — ***09/2014 -***
The neurophysiology of visual search. *Role: Postdoctoral researcher*

Zegar Family Foundation grant — ***07/2015-06/2018***
Remembering the World Around Us. *Role: Postdoctoral researcher*

COMPLETED

NINDS training grant from 2T32MH015174-35 — ***09/2011-09/2013***
Brain & Behavior Research Foundation (NARSAD) 2013 — ***012014-01/2016***
Young Investigator Award

CONFERENCE PRESENTATIONS AND PUBLICATIONS

1. **Semework, M.** *Laboratory based research in Neuroscience.* 8th Global Ethiopian Diaspora Conference on Healthcare and Medical Education, September 17, 2016. Washington, DC.
2. **Semework, M.**, 2013. *Retinotopic and spatial responses in monkey parahippocampal gyrus*. Platform presentation at: Gordon Research Seminar on Eye Movements (GRS). Stonehill College, MA. July 6-7.
3. **Semework, M.,** 2013. *"He/She is A Jerk, but Genius!": Humane Treatment of Humans in Research*. Platform presentation at: 7th International Conference on Ethical Issues in Biomedical Engineering; Brooklyn, NY.
4. **Semework, M**., 2011. *Brain Microstimulation Ethical Concerns*. Platform presentation at: 6th International Conference on Ethical Issues in Biomedical Engineering; Brooklyn, NY.

5. Seth, S., Brockmeier, A., Choi, J., **Semework M.,** Francis, J. T. 2011. Evaluating dependence in spike train metric spaces. International Joint Conference on Neural Networks San Jose, California.
6. Seth, S., II, Park, Brockmeier, A., **Semework, M.,** Choi, J., Francis, J., Principe, J. 2010. *A novel family of non-parametric cumulative based divergences for point processes*. In Lafferty, J., Williams, C., Shawe-Taylor, J., Zemel, R., Culotta, A. (Eds.), Advances in Neural Information Processing Systems 23. 2119-2127.
7. **Semework, M.,** 2010. *Brain Electrical Stimulation Ethical and Safety Issues*. (Platform presentation, abstract published). K.E. Herold, W.E. Bentley, and J. Vossoughi (Eds.): SBEC 2010, IFMBE.
8. **Semework, M**., 2010. *A Simple Structural Magnetic Resonance Imaging (MRI) Method for 3D Mapping Between Head Skin Tattoos and Brain Landmarks*. (Platform presentation, abstract published). K.E. Herold, W.E. Bentley, and J. Vossoughi (Eds.): SBEC 2010, IFMBE.
9. **Semework, M**., 2010. *A Simple Structural Magnetic Resonance Imaging (MRI) Method for 3D Mapping Between Head Skin Tattoos and Brain Landmarks*. K.E. Herold, W.E. Bentley, and J. Vossoughi (Eds.): SBEC 2010, IFMBE Proceedings 32, pp. 493–495.

POSTERS AND ABSTRACTS

1. **Semework, M.,** Goldberg, M. E. 2016. *Parahippocampal gyrus neurons in the monkey respond to stimuli in the entire visual field except for the foveal region.* Poster presented at: Society for Neuroscience Annual Meeting 2016; San Diego, CA
2. **Semework, M.** 2014. *A novel composition for use in imaging procedures**.*** Poster presented at: Society for Neuroscience Annual Meeting 2014; Washington, DC.
3. **Semework, M.,** Goldberg, M. E. 2013. *Retinotopic and spatial responses in monkey parahippocampal gyrus*. Poster presented at: Gordon Research Conference: Eye Movements (GRC). Stonehill College, MA. July 7-12.
4. **Semework M**., Kao T, Goldberg M. E. 2012. LIP *Environmental memory: source, importance and mechanisms of action.* Poster presented at: European Summer School on Visual Neuroscience. Rauischholzhausen, Germany. Aug 19 - 31 ***2012.***
5. Song, W., **Semework, M.,** Francis, J. T. 2011. *Neuronal cortical network reorganization after microstimulation in thalamus (VPL) and somatosensory cortex (S1**).*** Poster presented at: Society for the Neural Control of Movement 20th Annual Conference; San Juan, PR.
6. **Semework, M.,** Xu, S., Chhatbar, P., Francis, J. T. 2011. *Somatosensory Neuroprosthesis via Microstimulation: Comparison between S1 Cortex vs. VPL Thalamus**.*** Poster presented at: Society for Neuroscience Annual Meeting 2011; Washington, DC.
7. **Semework, M.**, Xu, S., Choi, J. and Francis, J. T. 2010. *Somatosensory Neuroprosthesis: Custom-fitting Microstimulation Parameters.* Poster presented at: Society for the Neural Control of Movement 19th Annual Conference; Naples, FL.
8. Xu, S., Hawley, E., von Kraus, L., **Semework, M.,** Chapin, J. K., and Francis, J. T. 2010. *A multichannel constant current stimulator for intracortical stimulation.* Poster presented at: Society for Neuroscience Annual Meeting 2010; San Diego, CA.
9. Chhatbar, P., **Semework, M.,** Xu, S., Marsh, B., Francis, J. T. 2010. *Force Control in Brain-Machine Interface.* Poster presented at: Society for Neuroscience Annual Meeting 2010; San Diego, CA.
10. **Semework, M.,** Xu, S., Francis, J. T. 2010. *Mapping Direct Responses and Afferent Modulation in Thalamo-cortical Networks in Microstimulation for Somatosensory Neuroprosthesis.* Poster presented at: Society for Neuroscience Annual Meeting 2010; San Diego, CA.
11. **Semework, M.,** Song, W., Xu, S., Francis, J. T. 2010. *Microstimulation in Awake Monkey with Chronic Ventral Posterolateral Thalamus (VPL) and Somatosensory Cortex (S1) Implants.* Poster presented at: DARPA Neural Engineering, Science, and Technology (NEST) Forum. San Diego, CA.

12. Chhatbar, P., **Semework, M.**, Francis, J. T. 2009. *Relationship between Neural Activity in Multiple Sensorimotor Cortices and Force-related Variables during Primate Reaching Movements*. Poster presented at: Society for Neuroscience Annual Meeting 2009; Chicago, IL.
13. Xu, S., **Semework, M.**, Rozenboym, A.V., Chhatbar, P.Y., Francis, J. T. and Chapin, J. K. 2009. *Neurophysiological Effects of Microstimulation in Rat and Monkey Somatosensory Thalamus*. Poster presented at: Society for Neuroscience Annual Meeting 2009; Chicago, IL.
14. Chhatbar, P., **Semework, M.**, vonKraus, L., Rozenboym, A., Francis, J. T. 2009. *Long-term Stability of Cortical Neural Ensemble Recordings Between Different Microelectrode Array Types.* Poster presented at: Society for the Neural Control of Movement 19th Annual Conference; Waikoloa, HI.
15. **Semework, M.**, Chhatbar, P., Rozenboym, A.V., vonKraus, L., Xu, S., Chapin, J. K., and Francis, J. T. 2009. *Somatosensory Neuroprosthesis: Where Best to Stimulate: Peripheral, VPL or Cortical?* Poster presented at: Society for the Neural Control of Movement 19th Annual Conference; Waikoloa, HI.
16. Francis, J. T., Rozenboym, A., **Semework, M.**, Chhatbar, P., Chapin, J. K. 2008. *On the Way to a Somatosensory Neuro-Prosthesis*. Poster presented at: From the Bench to the Bedside: The Latest Discoveries in SCI research at NYAS; New York, NY.
17. Chhatbar, P., **Semework, M.**, von Kraus, L., Francis, J. T. 2008. *Comparison Study of the Long-term Stability of Cortical Neural Ensemble Recordings Between Different Types of Microelectrode Arrays*. Poster presented at: Society for Neuroscience Annual Meeting 2008; Washington, DC.
18. **Semework, M.**, Chhatbar, P., von Kraus, L., Hawley, E., Xu, S., Chapin, J. K., and Francis, J. T. 2008. *Can Micro-stimulation in the Proprioceptive Brain Areas Mimic Novel Dynamic Force Perturbations Applied to the Arm?* Poster presented at: Society for Neuroscience Annual Meeting 2008; Atlanta, GA.

OTHER

Work authorization: U.S. permanent resident
Language skills: English, Hebrew, Amharic (native)
Interests: Invention, science, writing, philanthropy