BIOGRAPHICAL SKETCH

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NAME: William G. Coon

eRA COMMONS USER NAME (credential, e.g., agency login): WGREYCOON

POSITION TITLE: Senior Professional Staff, Johns Hopkins University Applied Physics Laboratory (JHU/APL)

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
McGill University	B.Sc.	2007	Psychology and Neuroscience
State University of New York at Albany	Ph.D.	2015	Biomedical Sciences: Neuroscience
Harvard Medical School	T32 Postdoctoral Fellow	2017-2019	Sleep, Circadian and Respiratory Neurobiology

A. Personal Statement

Summary

I am a sleep scientist and neural signals engineer with a PhD in brain signal processing and training in brain-computer interfacing (BCI), pattern classification and artificial intelligence (AI). In the field of sleep research, I'm interested in how the brain processes information during different sleep states, and how we can use that understanding to (1) design AI that "sleeps" to post-process information, and to (2) manipulate or enhance human memory & glymphatic "brain maintenance" with closed-loop neural stimulation BCIs during sleep.

In the BCI domain my work has focused on "hybrid sensing", i.e. leveraging the complementary information in different sensor domains like EEG (broad coverage, high temporal resolution) and fNIRS (high spatial resolution, high SNR), to improve BCI performance. This work, combined with my prior BCI experience and extensive history in sleep research, facilitated the jump to "sleep BCIs", or closed loop sensing-stimulating devices that sense and respond to ongoing neural activity during sleep.

One novel contribution to science from my work in this area is a neural-network based sleep stage classifier, embedded in a system that *operates in real-time* on ongoing EEG activity recorded from the forehead. When coupled with an auditory stimulator, this device becomes a powerful, fully automated A.I-driven sleep BCI system that can, for example, sense EEG slow waves and respond only during desired sleep stages with auditory stimuli timed to specific phases of subsequent slow waves with millisecond precision. The hope is that such systems can be used for at-home clinical sleep assessment and possibly for novel therapeutic applications in diseases or conditions that impair glymphatic system function, like traumatic brain injury (TBI) or primary sleep disorders, and that may be treated by stimulating glymphatic activity with closed-loop slow wave stimulation.

B. Positions and Honors

Positions and Employment
11/19 – present   Senior Staff Scientist
                Johns Hopkins University Applied Physics Lab, Laurel, MD

06/17 – 11/19	Research Fellow (T32 Postdoctoral Fellowship Awardee)	
	Division of Sleep Medicine, Harvard Medical School, Boston, MA	
02/17 – 11/19	Research Fellow	
	Department of Psychiatry, Massachusetts General Hospital, Boston, MA	
09/15 – 02/17	Visiting Scholar	
	National Center for Adaptive Neurotechnologies, NYS Dept. of Health, Albany, NY	
09/15 – 01/17	Research Scientist, Division Head	
	g.tec neurotechnology / g.tec medical engineering GmbH, Albany, NY	
09/10 – 09/15	Doctoral Candidate	
	Dept. of Biomedical Science, State University of New York. Albany, NY	
05/07 – 08/10	Senior Research Technologist	
	Chronobiology & Sleep Research Lab, EP Bradley Hospital, Providence, RI.	
05/06 – 08/06	William C. Dement Fellow	
	Chronobiology & Sleep Research Lab, EP Bradley Hospital, Providence, RI.	

Academic and Professional Honors

06/21   IEEE Best Paper, Neural Engineering Research (NER'21)

03/18   Neal Alan Mysell Award for Psychiatry Research Finalist (Harvard Medical School)

06/17   Harvard Medical School: Research Training Program in Sleep, Circadian and Respiratory Neurobiology, Postdoctoral Research Trainee Award

12/15   Distinguished Doctoral Dissertation Award

09/10   NSF IGERT Award

05/06   William C. Dement Predoctoral Research Fellowship Award

C. Contributions to Science

Journal articles

Coon WG and Punjabi, N. "Automatic sleep staging using a small-footprint sensor array and recurrent-convolutional neural networks". 10th International IEEE/EMBS Conference on Neural Engineering (NER), 2021, pp. 1144-1147. IEEE DOI: 9441432

Robinson BS, Polevoy AC, McDaniel SL, **Coon WG**, Scholl CA, McLean M, and Johnson EC. "A spiking network model for semantic representation and replay-based association acquisition". *ICONS (2021).*

Paraskevopoulou, S.E., **Coon, W.G.**, Brunner, P., Miller, K.J., Schalk, G., "Within-Subject Reaction Time Variability: Role of Cortical Networks and Underlying Neurophysiological Mechanisms". NeuroImage (*in press, Apr. 2021*).

Cho H, Schalk G, Adamek A, Moheimanian L, **Coon WG**, Jun SC, Wolpaw JR, and Brunner P. "Revealing the physiological origins of event-related potentials using electrocorticography in humans". eLife (*in press, Feb. 2021; bioRxiv: https://doi.org/10.1101/2021.02.12.430921*).

Coon WG, Valderrama M, Varela C, le van Quyen, M, Flores, F, Wilson M, and Manoach, DS. "Do human sleep spindles engaged with hippocampal ripples have a characteristic scalp EEG signature?". *SLEEP 2019; 42(supple_1). SLEEP DOI.*

Mylonas D, Tocci C, **Coon WG**, Baran B, Kohnke E, Zhu L, Vangel MG, Stickgold R, and Manoach, DS. "Naps reliably estimate nocturnal sleep spindle density in health and schizophrenia." *Journal of Sleep Research* (2019): e12968. PMID: 31860157

Erilmaz H., Dowling KF, Hughes DE, Rodriguez-Thompson A, Tannner A, Huntington C, **Coon WG**, and Roffman JL (2020). "Working Memory load-dependent changes in network connectivity estimated by machine learning". *Neuroimage* (2020): 116895

Swift JR, **Coon WG**, Guger C, Brunner P, Bunch M, Lynch T, Frawley B, Ritaccio AL, Schalk G (2018). Passive functional mapping of receptive language areas using electrocorticographic signals. *J. Clin. Neurophys.* 129(12):2517-2524. PMID: 30342252

Kapeller C, Ogawa H, Kunii N, **Coon WG**, Scharinger J, Guger C, Kamada K (2018). Real-time detection and discrimination of visual perception using electrocorticographic signals. *J Neural Eng* 15(3):036001

Schalk G, Marple J, Knight RT, & **Coon WG** (2017). An Alternative to Power- and Phase-based Interpretation of Oscillatory Brain Activity. *NeuroImage.* 157(2017):545-554. PMID: 28624646

Coon WG & Schalk G (2016). A Method to Identify the Location and Onset of Task-Related Cortical Activity from Human Electrocorticographic Signals in Single Trials. *Journal of Neuroscience Methods*, 271 (2016): 76-85. PMID: 27427301

Coon WG, Gunduz A, Brunner P, Ritaccio A, Pesaran B, & Schalk G. (2016). Oscillatory Activity Modulates the Timing of Neuronal Activations and Resulting Behavior. *NeuroImage.* 133 (2016): 294-301. PMID: 26975551

Saletin JM, **Coon WG**, & Carskadon MA (2016). Stage 2 Sleep EEG Sigma Activity and Motor Learning in Childhood ADHD: A Pilot Study. *Journal of Clinical Child & Adolescent Psychology.* June (2016): PMID: 27267670.

de Pesters A, **Coon WG**, Brunner P, Gunduz A, Ritaccio A, de Weerd P, Roberts P, Brunet N, Oostenveld R, Fries P, & Schalk G (2016). Alpha Power Indexes Task-Related Networks on Large and Small Scales: Evidence from ECoG in a Multimodal Study in Humans and a non-Human Primate. NeuroImage. 134 (2016): 122-131. PMID: 27057960

Federenko E, Scott T, Brunner, P, **Coon WG**, Schalk G, & Kanwisher N (2016). Neural Correlate of the Construction of Sentence Meaning. PNAS. 113(41): E6256-E6262.

Liu Y, **Coon WG**, de Pesters A, Brunner P, & Schalk G (2015). The Effects of Spatial Filtering and Artifacts on Electrocorticographic Signals. Journal of Neural Engineering. 12.5 (2015): 056008. *co-lead author. PMID 26268446

Dijkstra K, Brunner P, Gunduz A, **Coon WG**, Ritaccio A, Farquhar J, & Schalk G (2015). Identifying the Attended Speaker Using Electrocorticographic (ECoG) Signals. Brain-Computer Interfaces. 2.4 (2015): 161-173.

Peer-reviewed Conference Proceedings

Irimia D, Sabathiel N, Ortner R, Poboroniuc M, Allison BZ, **Coon WG**, Guger C (2016). recoveriX: A New BCI-based Technology for Persons with Stroke. Conf Proc IEEE Eng Med Biol Soc. DOI: 10.1109/EMBC.2016.759099

Book Chapters

Saletin JM, **Coon WG**, & Carskadon MA (2018). Stage 2 Sleep EEG Sigma Activity and Motor Learning in Childhood ADHD. In: Sleep and Developmental Psychology, Meltzer, L, ed., Routledge, ch. 2

Brunner P, Dijkstra K, **Coon WG**, Mellinger J, Ritaccio A, Schalk G (2017). An ECoG-based BCI based on Auditory Attention to Natural Speech. In: Brain-Computer Interface Research: A State-of-the-art Summary, Guger C, Allison B, Ushiba J, eds., Springer Press, pp. 7 – 19

Poster Presentations (2018 – present)

Coon WG, Valderrama M, Varela C, Amaya V, Fernandez F, Stickgold R, Wilson M, Manoach D (2019). "Hippocampal Ripple-Coupled Sleep Spindles (RiCS) Have a Distinct EEG Signature". APSS SLEEP 2019, San Antonio, TX

Coon WG, Valderrama M, Varela C, Amaya V, Fernandez F, Stickgold R, Wilson M, Manoach D (2019). "Improving the power of sleep spindles as a correlate of impaired memory, index of disease risk, and marker of treatment response". HMS Farrell Research Day 2019, Boston, MA

Coon WG, Mylonas D, Baran B, Demanuele C, Stickgold R, and Manoach D (2018). "Sleep spindle coherence and density predict sleep-enhanced learning in schizophrenia". APSS 2018, Baltimore, MD

Coon WG, Mylonas D, Baran B, Demanuele C, Stickgold R, and Manoach D (2018). "Sleep spindle coherence and density predict sleep-enhanced learning in schizophrenia". MGH Mysell Day 2018, Boston, MA

Invited Talks

2021 "*Automatic sleep staging using a small-footprint sensor array and recurrent convolutional neural networks*", NER '21

2019 "*Hippocampal Ripple-Coupled Sleep Spindles (RiCS) Have a Distinct EEG Signature and Correlate with Memory*", Cognitive Rhythms Collaborative, Boston University, Boston, MA

2019 "*Hippocampal Ripple-Coupled Sleep Spindles (RiCS) Have a Distinct EEG Signature and Correlate with Memory*", Brown University, Providence Sleep Research Interest Group, Providence, RI

2019 "*Sleep Oscillations and Memory Consolidation in Schizophrenia*", Brigham & Women's Sleep Interest Group, Boston, MA

2019 "*Introduction to EEG and intracranial EEG: Clinical and Research Applications*", Jun Kong Winter Program, Boston, MA

2018 "*Sleep Oscillations and Memory Consolidation in Schizophrenia*", MGH Martinos Center "Science-on-tap", Boston, MA

2018 "*Sleep Oscillations and Memory Consolidation: a Concurrent iEEG/scalp EEG Study Proposal*", National Center for Adaptive Neurotechnologies, Albany, NY

2018 "*Sleep and Memory: An Overview of the Field*", Prerau Lab, Boston, MA 2018 "*Sleep Oscillations and Memory Consolidation in Schizophrenia*", Harvard Medical School, Boston, MA

2017 Building Boston's Sleep Data Resource Capacities: Fostering Collaborations to Improve the Power and Meaning of Sleep-Related Data Analyses, Boston, MA

2016 *"Functional Brain Mapping with ECoG: Current and Future Directions",* EMBC, Orlando, FL

2016 *"Wireless EEG for Research and BCI",* EMBC, Orlando, FL

2016 *"Brain-computer Interfaces for communication and control",* Redwood Center for Theoretical Neuroscience Seminar, UC Berkeley

2015 Biomedical Science Seminar, State University of New York, Albany, NY

2014 ARO Annual Review Meeting, Irvine, CA

2012 NSF IGERT Review Meeting, Binghamton, NY

2011 Center for International Education, University of Massachusetts Amherst, MA

Reviewer Service

NeuroImage
Behavioral Sleep Medicine
Journal of Neural Engineering
IEEE Transactions on Biomedical Engineering
Journal of Neuroscience Methods