Jacek P. Dmochowski

Department of Biomedical Engineering
City College of New York
160 Convent Avenue
New York, NY 10031
U.S.A.

Phone: 212-650-8626
Fax: 212-650-5727

email: jdmochowski@ccny.cuny.edu
URL: http://dmochow.github.io

Born: December 10th, 1979—Gdansk, Poland
Citizenship: Polish, Canadian
Permanent Residency: United States

Appointments

2015- Assistant Professor, Department of Biomedical Engineering, City College of New York
2013-2015 Research Associate, Department of Psychology, Stanford University
2008-2013 Post-Doctoral Fellow, Department of Biomedical Engineering, City College of New York

Education

2008 PH.D., Telecommunications, Institut National de la Recherche Scientifique, Montreal, Canada
2005 M.A.Sc., Electrical Engineering, Carleton University, Ottawa, Canada
2003 B.ENG. WITH HIGH DISTINCTION, Communications Engineering, Carleton University, Ottawa, Canada

Research Interests

My research develops novel techniques for (i) non-invasively stimulating the brain and (ii) decoding neural signals. We are testing the transcranial application of ultrasound and near-infrared lasers to restore or enhance physiological activity in the central nervous system. Our efforts in neural decoding adopt a machine learning approach to infer brain states from neuroimaging data collected in naturalistic settings. We make extensive use of biophysical modeling of the human head as well as multivariate statistical techniques to optimize interventions and increase the sensitivity of our decoding methods. The research is expected to translate to new treatments for psychiatric and neurological disorders.

Research Support

2019-2021 *Boosting brain metabolism in spaceflight with transcranial photobiomodulation*
18-18BRASH2-0073, 800K
Investigators: Dmochowski (PI), Liu

2017-2020 *Repetitive transcranial ultrasonic stimulation for modulating brain rhythms*
NIH–NIDA K18DA045437-01, 300K
Investigators: Dmochowski (PI), Konofagou

2017-2021 *Reliability of neural responses as an assay of cognitive state*
ARL/DSO W911-NF-10-2-0022, 900K
Investigators: Dmochowski (PI), Parra

2020-2022 *Transcranial Near Infrared Radiation and Cerebral Blood Flow in Depression (TRIADE)*
NIH–NIMH R61MH122647-01
Investigators: Ionifescu (PI), Cassano, Collins, Dmochowski (co-I), deTaboada

2020-2025 *Transcranial Photobiomodulation for Alzheimer's Disease (TRAP-AD)*
NIH–NIA R01AG068248-01
Investigators: Ionifescu (PI), Brown, Cassano, Collins, Dmochowski (co-I)

2017-2021 *Novel neuromodulation by transcranial infrared brain stimulation with imaging*
NIH–NIMH R01MH14285-01
Investigators: Liu (PI), Gonzalez-Lima, Husain, Zeng, Dmochowski (Consultant)

2017-2019 *Non-invasive brain stimulation approaches to visual system modeling and plasticity*
NIH–NEI R21EY026748-01
Investigators: Norcia (PI), Vildavski, Dmochowski (Consultant)

2016-2020 *A tool-box to control and enhance tDCS spatial precision*
NIH–NIMH R01MH111896-01
Investigators: Bikson (PI), Dmochowski (co-I), Parra, Wang

Pending Research Support

2021-2025 *Explaining the variability in focused ultrasound neuromodulation*
NIH–NIGMS R16 GM145496-01.
Investigators: Dmochowski (PI), Wang, Konofagou

Publications

3,273 citations, h-index=27

Preprints (Under Review)

2020 Nugyen DT, Berisha D, Konofagou, **Dmochowski JP** (2020). Differential effects of amplitude-modulated transcranial focused ultrasound on excitatory and inhibitory neurons. *bioRxiv*, doi.org/10.1101/2020.11.26.400580.

Journal articles

2020 Ki JJ, Parra LC, **Dmochowski JP** (2020). Action enhances perception: Visually evoked neural responses are enhanced when engaging in a motor task. *European Journal of Neuroscience*, doi.org/10.1111/ejn.14924.

2020 Dmochowski GM, Shereen AD, Berisha D, **Dmochowski JP** (2020). Near infared light increases functional connectivity with a non-thermal mechanism. *Cerebral Cortex Communications*, 1(1), tgaa 0004.

2020 Kaneshiro, B., Nguyen, D. T., Norcia, A. M., **Dmochowski, J. P.***, Berger, J*. (2020). Natural Music Evokes Correlated EEG Responses Reflecting Temporal Structure and Beat. (*NeuroImage*), 116559. *co-senior authors

2019 Bikson M, **Dmochowski JP** (2019). What it means to go deep with non-invasive brain stimulation. *Clinical Neurophysiology*, 131(3), 752-754.

2019 Parra LC, Haufe S, **Dmochowski JP** (2019). Correlated Components Analysis—Extracting reliable dimensions in multivariate data, *Neurons, Behavior, Data Analysis and Theory*.

2019 Gebodh, N., Esmaeilpour, Z., Adair, D., Chelette, K., **Dmochowski J**, Woods, A. J. , Bikson, M. (2019). Inherent physiological artifacts in EEG during tDCS. *NeuroImage*, 185, 408-424.

2019 Wang X, **Dmochowski JP**, Zeng L, Kallioniemi E, Husain M, Gonzalez-Lima F, Liu, H. (2019). Transcranial photobiomodulation with 1064-nm laser modulates brain electroencephalogram rhythms. *Neurophotonics*, 6(2), 025013.

2018 **Dmochowski JP**, Ki JJ, DeGuzman P, Sajda P, Parra LC (2018). Extracting multidimensional stimulus-response correlations using hybrid encoding-decoding of neural activity. *NeuroImage*, 180, 134-146.

2018 Delis I, **Dmochowski JP**, Sajda P, Wang Q (2018). "Correlation of neural activity with behavioral kinematics reveals distinct sensory encoding and evidence accumulation processes during active tactile sensing", *NeuroImage*, 175, 12-21

2018 Bikson, M., Brunoni, A. R., Charvet, L. E., Clark, V. P., Cohen, L. G., Deng, Z. D., **Dmochowski J. P.**, Lim, K. O. (2018). Rigor and reproducibility in research with transcranial electrical stimulation: An NIMH-sponsored workshop. *Brain stimulation*, 11(3), 465-480.

2017 **Dmochowski JP**, Koessler L, Norcia AM, Bikson M, Parra LC (2017), "Optimal use of EEG recordings to target active brain areas with transcranial electrical stimulation", *NeuroImage*, 157:69-80

2017 **Dmochowski JP,** Bikson M (2017), Noninvasive neuromodulation goes deep. *Cell*, 169(6):977-978.

2017 Koessler L, Colnat-Coulbois S, Cecchin T, Hofmanis J, **Dmochowski JP**, Norcia, AM, Maillard LG (2017). "In-vivo measurements of human brain tissue conductivity using focal

electrical current injection through intracerebral multicontact electrodes", *Human brain mapping*, 38(2):974-986.

2017 Khadka N, Zannou AL, Zunara F, Truong DQ, **Dmochowski JP**, Bikson M (2017). "Minimal Heating at the Skin Surface During Transcranial Direct Current Stimulation". *Neuromodulation: Technology at the Neural Interface*.

2017 Poulsen AT, Kamronn S, **Dmochowski JP**, Parra LC, Hansen LK (2017). "EEG in the classroom: Synchronised neural recordings during video presentation". *Scientific Reports*, 7.

2016 Cancelli A, Cottone C, Tecchio F, Truong DQ, **Dmochowski JP**, Bikson M (2016). "A simple method for EEG guided transcranial electrical stimulation without models". *Journal of neural engineering*, 13(3):036022.

2015 **Dmochowski JP**, Norcia AM (2015). "Cortical Components of Reaction-Time during Perceptual Decisions in Humans". *PloS one*, 10(11):e0143339.

2015 **Dmochowski JP**, Greaves AS, Norcia AM (2015). "Maximally reliable spatial filtering of steady state visual evoked potentials". *NeuroImage*, 109:63–72.

2014 **Dmochowski JP**, Bezdek MA, Abelson BP, Johnson JS, Schumacher EH, Parra LC (2014). "Audience preferences are predicted by temporal reliability of neural processing". *Nature communications*, 5:4567.

2014 Richardson JD, Datta A, **Dmochowski JP**, Parra L, Fridriksson J. (2014). "HD-tDCS to enhance behavioral treatment for aphasia: A feasibility study". *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation*, 7(2):e9.

2014 Truong DQ, Huber M, Xie X., Datta A, Rahman A, Parra LC, **Dmochowski JP**, Bikson, M. (2014). "Clinician accessible tools for GUI computational models of transcranial electrical stimulation: BONSAI and SPHERES". *Brain stimulation*, 7(4): 521-524.

2013 **Dmochowski JP**, Datta A, Huang Y, Richardson JD, Bikson M, Fridriksson J, Parra LC (2013). "Targeted transcranial direct current stimulation for rehabilitation after stroke". *Neuroimage*, 75:12-19.

2013 Bikson M, **Dmochowski JP**, Rahman A. (2013). "The 'quasi-uniform' assumption in animal and computational models of non-invasive electrical stimulation". *Brain stimulation*, 6(4): 704.

2013 Huang Y, **Dmochowski JP**, Su Y, Datta A, Rorden C, Parra LC. (2013). "Automated MRI segmentation for individualized modeling of current flow in the human head". *Journal of neural engineering*, 10(6), 066004.

2013 Datta A, **Dmochowski JP**, Guleyupoglu B, Bikson M, Fregni F (2013). "Cranial electrotherapy stimulation and transcranial pulsed current stimulation: a computer based high-resolution modeling study". *Neuroimage*, 65:280-287.

2013 Dias JC, Sajda P, **Dmochowski JP**, Parra LC (2013). "EEG precursors of detected and missed targets during free-viewing search". *Journal of vision*, 13(13):13-13.

2012 **Dmochowski JP**, Bikson M, Parra LC (2012). "The point spread function of the human head and its implications for transcranial current stimulation". *Physics in medicine and biology*, 57(20):6459.

2012 **Dmochowski JP**, Sajda, P, Dias J, Parra, LC (2012). "Correlated components of ongoing EEG point to emotionally laden attention–a possible marker of engagement?" *Frontiers in human neuroscience*, 6.

2011 **Dmochowski JP**, Datta A, Bikson M, Su Y, Parra LC (2011). "Optimized multi-electrode stimulation increases focality and intensity at target". *Journal of neural engineering*, 8(4):046011.

2010 **Dmochowski JP**, Sajda P, Parra LC (2010). "Maximum likelihood in cost-sensitive learning: Model specification, approximations, and upper bounds". *Journal of Machine Learning Research*, 11(Dec): 3313-3332.

2010 Sajda P, Pohlmeyer E, Wang J, Parra LC, Christoforou C, **Dmochowski JP**, Hanna B, Bahlmann C, Singh MK, Chang SF (2010). "In a blink of an eye and a switch of a transistor: cortically coupled computer vision". *Proceedings of the IEEE*, 98(3):462-478.

2010 Habets EAP, Benesty J, Cohen I, Gannot S, **Dmochowski JP** (2010). "New insights into the MVDR beamformer in room acoustics". *IEEE Transactions on Audio, Speech, and Language Processing*, 18(1):158-170.

2009 **Dmochowski JP**, Benesty J, Affes S (2009). "On spatial aliasing in microphone arrays". *IEEE Transactions on Signal Processing*, 57(4):1383-1395.

2009 **Dmochowski JP**, Benesty J, Affes S (2009). "An information-theoretic view of array processing". *IEEE transactions on audio, speech, and language processing*, 17(2):392-401.

2008 **Dmochowski JP**, Benesty J, Affes S (2008). "Linearly constrained minimum variance source localization and spectral estimation". *IEEE transactions on audio, speech, and language processing*, 16(8):1490-1502.

2007 **Dmochowski JP**, Benesty J, Affes S (2007). "A generalized steered response power method for computationally viable source localization". *IEEE Transactions on Audio, Speech, and Language Processing*, 15(8):2510-2526.

2007 **Dmochowski JP**, Benesty J, Affes S (2007). "Direction of arrival estimation using the parameterized spatial correlation matrix". *IEEE Transactions on Audio, Speech, and Language Processing*, 15(4):1327-1339.

2007 Benesty J, Chen J, Huang Y, **Dmochowski JP** (2007). "On microphone-array beamforming from a MIMO acoustic signal processing perspective". *IEEE Transactions on Audio, Speech, and Language Processing*, 15(3):1053-1065.

2007 **Dmochowski JP**, Goubran RA (2007). "Decoupled beamforming and noise cancellation". *IEEE Transactions on Instrumentation and Measurement*, 56(1):80-88.

Peer-reviewed conference proceedings

2017 Gang N, Kaneshiro N, Berger J, **Dmochowski JP** (2017). Decoding neurally relevant musical features using canonical correlation analysis. In *Proceedings of ISMIR*.

2017 Losorelli S, Nguyen, DT, **Dmochowski JP**, Kaneshiro B. (2017). NMED-T: A tempo-focused dataset of cortical and behavioral responses to naturalistic music. In *Proceedings of*

2015 *ISMIR*. Kaneshiro B, **Dmochowski JP** (2015). "Neuroimaging Methods for Music Information Retrieval: Current Findings and Future Prospects". In *Proceedings of ISMIR*, 538-544.

2014 Zhang JR, Sherwin J, **Dmochowski J**, Sajda P, Kender JR (2014). "Correlating Speaker Gestures in Political Debates with Audience Engagement Measured via EEG". In *Proceedings of the 22nd ACM international conference on multimedia*, 387-396.

2014 Kaneshiro B, **Dmochowski JP**, Norcia AM, Berger J (2014). "Toward an objective measure of listener engagement with natural music using inter-subject EEG correlation". In *Proceedings of the 2014 International Conference on Music Perception and Cognition*.

2012 **Dmochowski JP**, Bikson M, Datta A, Richardson J, Fridriksson J, Parra LC (2012). "On the role of electric field orientation in optimal design of transcranial current stimulation". In *Proceedings of the 2012 Annual International Conference of the IEEE Engineering in Medicine*

and Biology Society, 6426-6429.

2012 Huang Y, Su Y, Rorden C, **Dmochowski J**, Datta A, Parra LC (2012). "An automated method for high-definition transcranial direct current stimulation modeling". In *Proceedings of the 2012 Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 5376-5379.

2011 **Dmochowski JP**, Bikson M, Datta A, Su Y, Parra LC (2011). "A multiple electrode scheme for optimal non-invasive electrical stimulation". In *Proceedings of the 5th International IEEE/EMBS Conference on Neural Engineering*, 29-35.

2008 **Dmochowski J**, Benesty J, Affes S (2008). "On the use of autoregressive modeling for localization of speech". In *Proceedings of the IEEE Sensor Array and Multichannel Signal Processing Workshop*, 353-356.

2008 **Dmochowski JP**, Liu Z, Chou PA (2008). "Blind source separation in a distributed microphone meeting environment for improved teleconferencing". In *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing*, 89-92.

2008 **Dmochowski JP**, Benesty J, Affes S (2008). "Fast steered response power source localization using inverse mapping". In *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing*, 289-292.

2008 **Dmochowski J**, Benesty J, Affes S (2008). "Calibrated acoustic source localization". In *Proceedings of the 24th IEEE Biennial Symposium on Communications*, 383-386.

2007 **Dmochowski JP**, Benesty J, Affes S (2007). "Broadband music: opportunities and challenges for multiple source localization". In *Proceedings of the 2007 IEEE Workshop on the Applications of Signal Processing to Audio and Acoustics*, 18-21.

2007 **Dmochowski J**, Benesty J, Affes S (2007). "Direction of arrival estimation using eigenanalysis of the parameterized spatial correlation matrix". In *Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing*, 1-4.

2007 **Dmochowski J**, Benesty J, Affes S (2007). "The generalization of narrowband localization methods to broadband environments via parametrization of the spatial correlation matrix". In *Proceedings of the 15th European Signal Processing Conference*, 763-767.

2005 **Dmochowski J**, Goubran R (2005). "Combined Beamforming and Noise Cancellation". In *Proceedings of the IEEE Instrumentation and Measurement Technology Conference*, 1033-1037.

2004 **Dmochowski JP**, Goubran R (2004), "Noise cancellation using fixed beamforming". In *Proceedings of the IEEE Workshop on Haptic, Audio and Visual Environments and their Applications*, 141-145.

Book chapters

2019 Woods, A. J., Bikson, M., Chelette, K., **Dmochowski, J.**, Dutta, A., Esmaeilpour, Z., ... Stagg, C. (2019). Transcranial direct current stimulation integration with magnetic resonance imaging, magnetic resonance spectroscopy, near infrared spectroscopy imaging, and electroencephalography. In *Practical Guide to Transcranial Direct Current Stimulation* (pp. 293-345). Springer, Cham.

2019 Reato, D., Salvador, R., Bikson, M., Opitz, A., **Dmochowski, J.**, Miranda, P. C. (2019). Principles of transcranial direct current stimulation (TDCS): introduction to the biophysics of

TDCS. In *Practical Guide to Transcranial Direct Current Stimulation* (pp. 45-80). Springer, Cham.

2010 **Dmochowski JP**, Benesty J (2010), *Microphone arrays: fundamental concepts*, In *Speech Processing in Modern Communication*, 199-223, Springer Berlin Heidelberg.

2010 **Dmochowski JP**, Benesty J (2010), *Steered beamforming approaches for acoustic source localization*, In *Speech Processing in Modern Communication*, 307-337, Springer Berlin Heidelberg.

Awards

2019 North American Neuromodulation Society (NANS), Best Clinical Abstract

2017 City University of New York, Junior Faculty Research Award

2009 Governor General of Canada's Academic Gold Medal

Intellectual Property

2020 Bach D, Chelian S, Deguzman P, **Dmochowski J**, Kruse, A, Mcburnett W, Miller SL, Nugent TF, Sajda, P, "Identifying and strengthening physiological/neurophysiological states predictive of superior performance". U.S. Patent Application 16/504,098. 2020 Jan 9.

2016 Parra LC, Sajda P, DeGuzman P, Rosenthal D, Cloud P, **Dmochowski JP**, "Method for measuring physiological impact of stimulus features to predict response of subjects to stimuli including such stimulus features". Filed (US).

2013 Parra LC, **Dmochowski JP**, "Predicting Response to Stimulus". United States patent application US 14/433,279. 2013 Oct 11.

2013 Bikson M, Datta A, Parra LC, **Dmochowski J**, Su Y. Neurocranial electrostimulation models, systems, devices, and methods. United States patent US 8,494,627. 2013 Jul 23.

2012 Liu Z, Chou PA, **Dmochowski J**, "Speech separation with microphone arrays". United States patent US 8,144,896. 2012 Mar 27.

Industrial Experience

2020 Niraxx, Consultant

2019- Optios, Consultant

2014-2019 Neuromatters LLC, Consultant

2011-2017 Soterix Medical Inc, Consultant

2008 Broadcom Corporation, Intern

2007 Microsoft Research, Intern

Educational Activities

Teaching

Undergraduate

2016-2021 City College of New York: BME 20500, Bioelectrical Circuits with Lab
Mean teaching efficacy score: 93/100
2018 City College of New York: BME 50500 Image and Signal Processing in Biomedicine
Mean teaching efficacy score: 100/100

Graduate

2017-2020 City College of New York: BME I9400, Special Topics in Machine Learning
2018-2020 City College of New York: BME I0000, Biomedical Engineering Seminar

Graduate Students Supervised

2019- Kevin Walsh, Ph.D. Candidate, City College of New York
2018- Duc Nguyen, Ph.D. Candidate, City College of New York
2015- Jason Ki, Ph.D. Candidate, City College of New York
2016-2019 Prakhyat Singh, M. Eng., City College of New York
currently employed at FDA Office of Neurological Devices

Undergraduate Research Assistants

2019- Amilcar Malave, Biomedical Engineering
2018- Gazi Inkiyad, Biomedical Engineering
2017- Destiny Berisha, Biomedical Engineering

High School Research Volunteers

2019-2020 Alexandra Kuhl
2017 Jessica Burg

Doctoral Committee Member

2021 Gozde Unal, City College of New York, Biomedical Engineering
2021 Forouzan Farahani, City College of New York, Biomedical Engineering
2020 Maximillian Nentwich, City College of New York, Biomedical Engineering
2020 Naomi Gaggi, Graduate Center of the City University of New York, Neuroscience
2020 Niranjan Khadka, City College of New York, Biomedical Engineering
2020 Gregory Kronberg, City College of New York, Biomedical Engineering
2020 Kivilcim Afacam, City College of New York, Biomedical Engineering
2018 Ivan Iotzov, City College of New York, Biomedical Engineering
2017 Samantha Cohen, City College of New York, Biomedical Engineering

2017 Dennis Truong, City College of New York, Biomedical Engineering

Service

National Review Panels

2019-2021 National Institutes of Health (NIH) Study Section Member
ETTN-C
Clinical Neurophysiology, Devices, Neuroprosthetics, and Biosensors
2020 National Institutes of Health (NIH) Study Section Member
CDIN
Chronic Dysfunction and Integrative Neurodegeneration

Ad-hoc Journal Reviewer

Nature Communications
eLife
NeuroImage
Brain Stimulation
Journal of Neural Engineering
Neurophotonics
PLoS ONE

Invited Talks & Seminars

2020 North American Neuromodulation Society (NANS) Annual Meeting, Neuromodulatory Effects of Near Infrared Laser Stimulation, January 2020
2019 New York University School of Medicine, Interrogating Brain Oscillations with Focused Ultrasound, August 2019
2019 Nathan Kline Psychiatric Institute, Shining Light on Brain Metabolism, June 2019
2019 City University of New York Advanced Science Research Center, Shining Light on Brain Metabolism, April 2019
2019 University of Texas – Arlington, Non-Invasive Decoding of Brain State with EEG, March 2019
2019 North American Neuromodulation Society, Transcranial Laser Stimulation Increases Cerebral Blood Oxygenation in Humans, January 2019
2018 NYC Neuromodulation, Effects of Transcranial Laser Stimulation on the BOLD Signal, August 2018
2018 NYC Neuromodulation, Optimizing HD-tDCS for non-invasive stimulation of deep regions, August 2018
2018 Montclair High School, Introduction to Neural Engineering, March 2018
2018 North American Neuromodulation Society, The Use of EEG to Optimize the Application of Transcranial Electrical Stimulation, January 2018

2017 University Hospital of Nancy (France), Reciprocal Transcranial Electrical Stimulation, September 2017

2017 Stanford University, Engagement is in the brain, July 2017

2017 NYC Neuromodulation, Targeted stimulation of active brain sources using electromagnetic reciprocity, January 2017

2016 Queen's University, Targeted stimulation of active brain sources using electromagnetic reciprocity, October 2016

2016 Google Research, Neural correlates of media engagement, September 2016

2016 Technical University of Denmark, Natural stimulus evoked responses as an assay of cognitive state, July 2016

2016 Army Research Laboratory, Natural stimulus evoked responses as an assay of cognitive state, May 2016

2015 Neuromodec, Designing tDCS montages for clinical efficacy, November 2015

2014 Shazam Entertainment Ltd., Neural correlates of media engagement, July 2014

2014 Stanford University, Reliable components of EEG are the neural signatures of accumulation-to-bound in a fine perceptual-decision making task, June 2014

2014 Association for Psychological Science Annual Convention, EEG synchrony, narrative engagement, and viewing behavior, May 2014

2014 Vision Sciences Society Annual Meeting, Neural dynamics of fine motion-direction discrimination, May 2014

2013 Stanford University, Dimensions of neural reliability, December 2013

2013 Stanford University, Measuring audience engagement with neural signals, October 2013

2012 Stanford University, Optimized multichannel transcranial current stimulation, August 2012

2012 Arizona State University, Reading the brain during movie viewing, June 2012

2012 Rutgers University, Correlated components analysis: reading the brain during movie viewing, March 2012

2011 Rutgers University, A Multiple Electrode Scheme for Optimal Non-Invasive Electrical Stimulation, October 2011

2011 York University, Canonical correlates of EEG during movie viewing, September 2011

2011 City College of New York, Rules of engagement: Canonical Correlates of EEG During Movie Viewing, September 2011

2010 Montreal Neurological Institute, Real-time single-trial EEG decoding in a rapid serial visual presentation task, May 2010

Internal Committees

2018- City College of New York, Biomedical Engineering Graduate Committee

2018- City College of New York, Information Technology and Website Committee