

# Bradley Voytek, Ph.D.

Associate Professor, UC San Diego  
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GitHub: <http://github.com/voytek>

Scholar: <https://scholar.google.com/citations?user=ydFvGx0AAAAJ>

## Education

2004–2010 University of California, Berkeley: PhD, Neuroscience (advisor: Robert T. Knight)  
1998–2002 University of Southern California: BA, Psychology

## Professional positions

### Academic

2020– Vice-chair: Data Science Major/Minor Steering Committee, UC San Diego  
2018– Associate Professor: UC San Diego, Department of Cognitive Science  
2018–2020 Fellow (endowed chair): Halicioğlu Data Science Institute (HDSI) of the  
University of California, San Diego  
2014–2018 Assistant Professor: UC San Diego, Department of Cognitive Science  
2011–2014 Post-doctoral Fellow (NIH/NIGMS): UC San Francisco (Adam Gazzaley)  
2010–2011 Post-doctoral Researcher: UC Berkeley (Mark D'Esposito)  
2004–2010 Graduate Student Researcher: UC Berkeley (Robert T. Knight)  
2002–2004 Staff Research Associate II: UCLA (Edythe D. London)  
2000–2002 Undergraduate Researcher: USC (Adrian Raine)

### Industry and non-profit

2019– Co-founder and Board Member: Data Science Alliance (501(c)(3) non-profit)  
2011– Advising: National Academy of Sciences, Science & Entertainment Exchange  
2011–2014 Data Scientist: Uber, Inc.

### Administrative

2019– Board Member: Halicioğlu Data Science Institute Industry Board, UC San Diego  
2019– Affiliate: Computational Social Science program, UC San Diego

2018– Affiliate: Institute for Practical Ethics, UC San Diego  
 2017– Executive Committee: Neurosciences Graduate Program, UC San Diego  
 2017– Executive Committee: Halicioğlu Data Science Institute, UC San Diego  
 2017– Advisory Board: Data Science Undergraduate Major, UC San Diego  
 2017 Founding Faculty: Halicioğlu Data Science Institute, UC San Diego  
 2017 Founding Faculty: Data Science Major, UC San Diego  
 2016– Advisory Board: Kavli Institute for Brain and Mind, UC San Diego  
 2014– Affiliate: UC San Diego, Institute for Neural Computation

## Honors and awards

2018–2022 Fellow: Halicioğlu Data Science Institute, UC San Diego  
 2016 New Attendee Travel Award: Computational & Systems Neuroscience (Cosyne)  
 2015 Kavli Fellow: National Academy of Sciences  
 2015 Alfred P. Sloan Research Fellow in Neuroscience  
 2013 President's Postdoctoral Fellowship Program: University of California  
 2011 AAAS Early Career Award for Public Engagement with Science (Finalist)  
 2010 Zombie Research Society: Georgie Award in Science  
 2009–2012 Society for Neuroscience: Neuroscience Scholars Program  
 2005 Outstanding Graduate Student Instructor: UC Berkeley, Molecular & Cell  
       Biology 163: Mammalian Neuroanatomy  
 2004–2007 American Psychological Association: Diversity Program in Neuroscience fellow  
 1998 Presidential Scholarship: USC  
 1998 Thematic Option Program: USC honors general education program  
 1998 Resident Honors Program: USC early college admittance program  
 1998 Undergraduate Physics scholarship: USC  
 1998 Hewlett Packard Outstanding Scholarship

## Publications

### Research

1. Bauer M, London ED, Rasgon N, Berman SM, Frye MA, Altshuler LL, Mandelkern MA, Bramen J, **Voytek B**, Woods R, Mazziotta JC, Whybrow PC. Supraphysiological doses of levothyroxine alter regional cerebral metabolism and improve mood in bipolar depression. *Mol Psychiatry* 10, 456-469 (2005).
2. **Voytek B**, Berman SM, Hassid BD, Simon SL, Mandelkern MA, Brody AL, Ling W, London ED. Differences in regional brain metabolism associated with marijuana abuse in methamphetamine abusers. *Synapse* 57, 113-115 (2005).
3. London ED, Berman SM, **Voytek B**, Simon SL, Mandelkern MA, Monterosso J, Thompson PM, Brody AL, Geaga JA, Hong MS, Hayashi KM, Rawson RA, Ling W. Cerebral metabolic dysfunction and impaired vigilance in recently abstinent methamphetamine abusers. *Biol Psychiatry* 58, 770-778 (2005).
4. Berman SM, **Voytek B**, Mandelkern MA, Hassid BD, Isaacson A, Monterosso JR, Miotto K, Ling W, London ED. Changes in cerebral glucose metabolism during early abstinence from chronic methamphetamine abuse. *Mol Psychiatry* 13, 897-908 (2008).

5. Bauer M, Berman SM, Schlagenhaut F, **Voytek B**, Rasgon N, Mandelkern MA, Whybrow PC, London ED. Regional cerebral glucose metabolism and anxiety symptoms in bipolar depression: Effects of levothyroxine. *Psychiatry Res* 181, 71-76 (2009).
6. **Voytek B**, Secundo L, Bidet-Caulet A, Scabini D, Stiver S, Gean AD, Manley G, Knight RT. Hemispherectomy: A new model for human electrophysiology with high spatio-temporal resolution. *J Cogn Neurosci* 22, 2491-2502 (2010).
  - **Media:** Wired ([link](#)); MindHacks ([link](#))
7. **Voytek B** & Knight RT. Prefrontal cortex and basal ganglia contributions to visual working memory. *Proc Natl Acad Sci USA* 107, 18167-18172 (2010).
  - **Media:** UC Berkeley press release ([link](#))
8. **Voytek B**, Canolty RT, Shestyuk A, Crone NE, Parvizi J, Knight RT. Shifts in gamma phase-amplitude coupling frequency from theta to alpha over posterior cortex during visual tasks. *Front Hum Neurosci* 4, (2010).
9. **Voytek B**, Davis M, Yago E, Barceló F, Vogel EK, Knight RT. Dynamic neuroplasticity after human prefrontal cortex damage. *Neuron* 68, 401-408 (2010).
  - **Media:** Faculty of 1000 ([link](#)), CBS News ([link](#)), The Washington Post ([link](#)), UC Berkeley press release ([link](#))
10. Løvstad M, Funderud I, Lindgren M, Endestad T, Due-Tønnessen P, Meling T, **Voytek B**, Knight RT, Solbakk AK. Contribution of subregions of human frontal cortex to novelty processing. *J Cogn Neurosci* 24, 378-395. (2012).
11. **Voytek B\***, Soltani M\*, Pickard N, Kishiyama MM, Knight RT. Prefrontal cortex lesions impair object-spatial integration. *PLOS ONE* 7, e34937 (2012). \*equal contribution
12. Voytek JB & **Voytek B**. Automated cognome construction and semi-automated hypothesis generation. *J Neurosci Methods* 208, 92-100 (2012).
  - **Media:** The Economist ([link](#)), Wired ([link](#)), Scientific American ([link](#)), MindHacks ([link](#)), Forbes ([link](#))
13. Løvstad M., Funderud I, Meling T, Krämer UM, **Voytek B**, Due-Tønnessen P, Endestad T, Lindgren M, Knight RT, Solbakk AK. Anterior cingulate cortex and cognitive control: Neuropsychological and electrophysiological findings in two patients with lesions to dorsomedial prefrontal cortex. *Brain Cognit* 80, 237-249 (2012).
14. Funderud I, Lindgren M, Løvstad M, Endestad T, **Voytek B**, Knight RT, Solbakk AK. Differential Go/NoGo activity in both contingent negative variation and spectral power. *PLoS ONE* 7, e48504 (2012).
15. **Voytek B**, D'Esposito M, Crone NE, Knight RT. A method for event-related phase/amplitude coupling. *NeuroImage* 64, 416-424 (2013).
16. Rolle CE, **Voytek B**, Gazzaley A. Exploring the potential of the iPad and Xbox Kinect for cognitive science research. *Games Health J* 4, 221-224 (2015).
17. **Voytek B**, Kayser A, Badre D, Fegen D, Chang EF, Crone NE, Parvizi J, Knight RT, D'Esposito M. Oscillatory dynamics coordinating human frontal networks in support of goal maintenance. *Nature Neurosci* 18, 1318-1324 (2015).
  - **Media:** Berkeley press release ([link](#))
18. **Voytek B**, Kramer MA, Case J, Lepage KQ, Tempesta ZR, Knight RT, Gazzaley A. Age-related changes in 1/f neural electrophysiological noise. *J Neurosci* 35, 13257-13265 (2015).

- **Media:** UCSF press release ([link](#))
19. Tran TT, Hoffner NC, LaHue SC, Tseng L, **Voytek B**. Alpha phase dynamics predict age-related visual working memory decline. *NeuroImage* 143, 196-203 (2016).
  20. Cole SR, van der Meij R, Peterson EJ, de Hemptinne C, Starr PA, **Voytek B**. Nonsinusoidal beta oscillations reflect cortical pathophysiology in Parkinson's disease. *J Neurosci* 37, 4830-4840 (2017).
  21. **Voytek B**, Samaha J, Rolle CE, Greenberg Z, Gill N, Porat S, Kader T, Rahman S, Malzyner R, Gazzaley A. Preparatory encoding of the fine scale of human spatial attention. *J Cogn Neurosci* 29, 1302-1310 (2017).
  22. Rolle CE, Anguera JA, Skinner SN, **Voytek B**, Gazzaley A. Enhancing spatial attention abilities in younger and older adults. *J Cogn Neurosci* 29, 1483-1497 (2017).
  23. Gao RD, Peterson EJ, **Voytek B**. Inferring synaptic excitation/inhibition balance from field potentials. *NeuroImage* 158, 70-78 (2017).
  24. van der Meij R & **Voytek B**. Uncovering neuronal networks defined by consistent between-neuron spike timing from neuronal spike recordings. *eNeuro* 5, (2018).
  25. Moore SM, Seidman JS, Ellegood J, Gao R, Savchenko A, Troutman TD, Abe Y, Stender J, Lee D, Wang S, **Voytek B**, Lerch JP, Suh H, Glass C, Muotri A. Setd5 haploinsufficiency alters neuronal network connectivity and leads to autistic-like behaviors in mice. *Translational Psychiatry* 9, 1-12 (2019).
  - **Media:** UC San Diego press release ([link](#))
  26. Cole SR, Donoghue T, Gao R, **Voytek B**. NeuroDSP: A package for neural digital signal processing. *J Open Source Software* 4, 1272 (2019).
  27. Jackson N, Cole SR, **Voytek B**, Swann NC. Characteristics of waveform shape in Parkinson's disease detected with scalp electroencephalography. *eNeuro* 6, (2019).
  - **Media:** University of Oregon press release ([link](#))
  28. Holdgraf C, Appelhoff S, Bickel S, Bouchard K, D'Ambrosio S, David O, Devinsky O, Dichter B, Flinker A, Foster BL, Gorgolewski KJ, Groen I, Groppe S, Gunduz A, Hamilton L, Honey CJ, Jas M, Knight R, Lachaux J-P, Lau JC, Lundstrom BN, Lee-Messer C, Miller KJ, Ojemann JG, Oostenveld R, Petridou N, Piantoni G, Pigorini A, Pouratian N, Ramsey NF, Stolk A, Swann NC, Tadel F, **Voytek B**, Wandell BA, Winawer J, Zehl L, Hermes D. iEEG-BIDS, extending the brain imaging data structure specification to human intracranial electrophysiology. *Scientific Data* 6, (2019).
  29. Veerakumar A, Tiruvadi V, Howell B, Waters AC, Crowell AL, **Voytek B**, Posse PR, Denison L, Rajendra JK, Edwards JA, Bijanki KR, Choi KS, Mayberg HS. Field potential I/f activity in the subcallosal cingulate region as a candidate signal for monitoring deep brain stimulation for treatment resistant depression. *J Neurophysiol* 122, 1023-1025 (2019).
  30. Cole S & **Voytek B**. Cycle-by-cycle analysis of neural oscillations. *J Neurophysiol* 122, 849-861 (2019).
  31. Trujillo CA\*, Gao R\*, Negraes PD\*, Chaim IA, Domissy A, Vandenberghe M, Devor A, Yeo GW, **Voytek B**#, Muotri AR#. Complex Oscillatory Waves Emerging from Cortical Organoids Model Early Human Brain Network Development. *Cell Stem Cell* 25, 558-569 (2019). \*,#equal contribution
  - **Media:** New York Times ([link](#))

- Discover Magazine's #7 Top Science Story of 2019 ([link](#))
- 32. Robertson MM, Furlong S, **Voytek B**, Donoghue T, Boettiger CA, Sheridan MA. EEG Power Spectral Slope differs by ADHD status and stimulant medication exposure in early childhood. *J Neurophysiol* 122, 2427-2437 (2019).
- 33. Molina JL, **Voytek B**, Thomas ML, Joshi YB, Bhakta SG, Talledo JA, Swerdlow NR, Light GA. Memantine effects on EEG measures of putative excitatory/inhibitory balance in schizophrenia. *Biol Psychiatry Cogn Neurosci Neuroimaging* (2020).
- 34. Ghatak S, Dolatabadi N, Gao R, Wu Y, Scott H, Trudler D, Sultan A, Ambasudhan R, Nakamura T, Masliah E, Talantova M, **Voytek B**, Lipton SA. NitroSynapsin ameliorates hypersynchronous neural network activity in Alzheimer hiPSC models. *Mol Psychiatry* (2020).
  - **Media:** Scripps Research Institute press release ([link](#))
- 35. Tran TT, Rolle CE, Gazzaley A, **Voytek B**. Linked sources of neural noise contribute to age-related cognitive decline. *J Cogn Neurosci* (2020).
- 36. Peterson EJ & **Voytek B**. Homeostatic mechanisms may shape the type and duration of oscillatory modulation. *J Neurophysiol* 124, 168-177 (2020).

## Reviews and perspectives

1. **Voytek B**. Emergent basal ganglia pathology within computational models. *J Neurosci* 26, 7317-7318 (2006).
2. Ritaccio A, Beauchamp M, Bosman C, Brunner P, Chang E, Crone N, Gunduz A, Gupta D, Knight R, Leuthardt E, Litt B, Moran D, Ojemann J, Parvizi J, Ramsey N, Rieger J, Viventi J, **Voytek B**, Williams J, Schalk G. Proceedings of the third international workshop on advances in electrocorticography. *Epilepsy Behav* 25, 605-613 (2012).
3. **Voytek B** & Gazzaley A. Stimulating the aging brain. *Ann Neurol* 73, 1-3 (2013). (editorial)
4. **Voytek B** & Knight RT. Dynamic network communication as a unifying neural basis for cognition, development, aging, and disease. *Biological Psychiatry* 77, 1089-1097 (2015).
  - **Media:** Forbes ([link](#))
5. **Voytek B**. The virtuous cycle of a data ecosystem. *PLOS Computational Biology* 12, 1-6 (2016).
6. Cole SR & **Voytek B**. Brain oscillations and the importance of waveform shape. *Trends Cogn Sci* 21, 137-149 (2017).
7. **Voytek B**. Social Media, Open Science, and Data Science are Inextricably Linked. *Neuron* 96, 1-4 (2017).

## Books and book chapters

1. **Voytek B** & Knight RT. Dynamic communication and connectivity in frontal networks. In *Mind and the Frontal Lobes: Cognition, Behavior, and Brain Imaging* (editors, Levine B & Craik FIM) New York (USA): Oxford University Press, (2010).
2. Cohen MX & **Voytek B**. Linking nonlinear neural dynamics to single-trial human behavior. In *Multiscale Analysis and Nonlinear Dynamics: from Molecules to the Brain* (editors, Schuster HG & Pesenson M) New York (USA): Wiley, (2013).

3. Verstynen T & **Voytek B**. Do Zombies Dream of Undead Sheep? A Neuroscientific View of the Zombie Brain: Princeton University Press, (2014).
  - **Translations:** Chinese (simplified), Japanese, Russian, Turkish, Ukrainian
  - **Awards:** American Publishers Professional and Scholarly Excellence (PROSE) Award (Biomedicine & Neuroscience)
  - **Media:** Science, BRAAAAINS, 2014 Oct. ([link](#)); The Lancet: Neurology, Hungry and angry: could we survive a zombie apocalypse?, 2014 Dec. ([link](#)); Scientific American, A True and Complete Account of the Neuroscience of Zombies, 2014 Nov. ([link](#)); Scientific American MIND, New Book Explores the Zombie Brain, 2015 Apr. ([link](#)).

#### Pre-print publications under review

1. Peterson EJ, Rosen BQ, Campbell AM, Belger A, **Voytek B**. I/f neural noise is a better predictor of schizophrenia than neural oscillations. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
2. Peterson EJ & **Voytek B**. Alpha oscillations control cortical gain by modulating excitatory-inhibitory background activity. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
3. Donoghue T\*, Haller M\*, Peterson E\*, Varma P, Sebastian P, Gao R, Noto T, Lara A, Wallis J, Knight RT, Shestyuk A#, **Voytek B**#. Parameterizing neural power spectra. bioRxiv ([preprint](#)), under review at a peer-reviewed journal. \*.#equal contribution
4. Peterson EJ & **Voytek B**. Healthy oscillatory coordination is bounded by single-unit computation. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
5. He W, Donoghue T, Sowman PF, Seymour RA, Brock J, Crain S, **Voytek B**, Hillebrand A. Co-Increasing neuronal noise and beta power in the developing brain. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
6. Donoghue T, Dominguez J, **Voytek B**. Electrophysiological frequency band ratio measures conflate periodic and aperiodic neural activity. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
7. Gao R, van den Brink RL, Pfeffer T, **Voytek B**. Neuronal timescales are functionally dynamic and shaped by cortical microarchitecture. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.
8. Brown DE, Chavez JI, Nguyen DH, Kadwory A, **Voytek B**, Arneodo E, Gentner TQ, Gilja V. Local field potentials in a pre-motor region predict learned vocal sequences. bioRxiv ([preprint](#)), under review at a peer-reviewed journal.

#### Refereed conference proceedings

1. Gao R & **Voytek B**. Inferring excitatory and inhibitory synaptic parameters from the local field potential. Computational and Systems Neuroscience (Cosyne), (2016). (56% acceptance rate)
2. Gao R, Donoghue T, **Voytek B**. Automated Generation of Cognitive Ontology via Web Text-Mining. Proceedings of the 39th Annual Conference of the Cognitive Science Society, (2017). (48% acceptance rate)

3. Gao R & **Voytek B.** Hierarchy of cortical population characteristic timescales inferred from field potentials. Computational and Systems Neuroscience (Cosyne), (2019). (35% acceptance rate)

## Other writings

1. **Voytek B.** What Bats, Bombs and Sharks Taught Us about Hearing. Scientific American, Jun 14, 2011. ([link](#))
2. **Voytek B.** What Is Peer Review for? Scientific American, Nov 2, 2011. ([link](#))
3. **Voytek B.** SfN is my nerd Disneyland. neuroscience@nature: action potential, Nov 12, 2011. ([link](#))
4. **Voytek B.** Automated science, deep data and the paradox of information. O'Reilly Radar: Insight, Analysis, and Research about Emerging Technologies, Mar 30, 2012. ([link](#))
5. **Voytek B.** In defense of frivolities and open-ended experiments. O'Reilly Radar: Insight, Analysis, and Research about Emerging Technologies, Jun 8, 2012. ([link](#))
6. **Voytek B.** There's something fishy about citations: We need a method of assessing the support of research if we want to change the 'publish or perish' culture. London School of Economics blog, Oct 17, 2012. ([link](#))
7. **Voytek B.** On the Horizon: foc.us. BBC Focus, Oct, 2013. ([link](#))
8. **Voytek B.** A Step-by-Step Breakdown of an Awake Brain Tumor Removal Surgery. Gizmodo, Oct 29, 2013. ([link](#))
9. **Voytek B.** What Does It Feel Like to Hold a Human Brain in Your Hands? Slate, Oct 30, 2013. ([link](#))

## Grants and funding

### Ongoing

- |           |   |
|-----------|---|
| 2020      | Intel Corporation: On Device Telemetry Workload Correlations with Personas and Environment. \$15,000.   |
| 2019–2023 | NIGMS R01 GM134363-01: Tools for parameterizing and visualizing electrophysiological rhythmic and arrhythmic features. PI: B. Voytek. \$1,262,000.  |
| 2018–2020 | Whitehall Foundation 2017-12-73: Prefrontal Oscillatory Mechanism of "Activity Silent" Memory. PI: B. Voytek. \$225,000.  |
| 2017–2020 | National Science Foundation DGE NRT 1735234: NRT-IGE: Augmenting, Piloting, and Scaling Computational Notebooks to Train New Graduate Researchers in Data-Centric Programming. Role: Co-PI; PI: James Hollan; Co-PIs: Philip Guo, Scott Klemmer. \$498,751. |

### Completed

- |           |   |
|-----------|---|
| 2019      | National Science Foundation Research Experiences for Undergraduates Supplement for BCS COGNEURO 1736028. \$9,600.           |
| 2018–2019 | UCSD Stem Cell Program, Embodied human organoid network oscillations. Role: Co-PI; PI: Alysson Muotri. \$100,000.           |
| 2018      | UC San Diego, Shiley-Marcos Alzheimer's Disease Research Center (ADRC): Research Training in Alzheimer's Disease, \$35,000. |

2018	National Science Foundation Research Experiences for Undergraduates Supplement for BCS COGNEURO I736028. \$9,600.
2018	UC Stem Cell Program Innovative Project Award. Co-Investigator; PI: A. Muotri. \$100,000.
2018	UC San Diego Special Initiatives Fund, ComSciCon: The Communicating Science Workshop for Graduate Students. Co-PI: R. Hendricks. \$5,000.
2017–2020	National Science Foundation BCS COGNEURO I736028: Oscillatory phase dynamics coordinate cognitive neural networks. PI: B. Voytek. \$471,777.
2017	Frontiers of Innovation Scholars Program (FISP). \$25,000.
2017	Kavli Institute for Brain and Mind Innovative Research Grant, Bridging Structure and Function with Neural Oscillations in iPSC-derived Cortical Organoids. Co-Investigator; PI: T. Olayinka. \$50,000.
2016	Kavli Institute for Brain and Mind Innovative Research Grant, Systems- and Synaptic-Level Overcoupling in Major Depressive Disorder. Co-Investigator; PI: T. Tran. \$50,000.
2015	Frontiers of Innovation Scholars Program (FISP). \$25,000.
2015	NIMH R01 MH095984-03S1, Revision Application to parent R01 “Oscillatory Contributions to Working Memory and Attention”. Co-Investigator; PI: B.R. Postle. Total direct costs \$133,581.
2015	The John A. Majda, M.D. Memorial Grant. Mentor; PI: M. Soltani. \$10,000.
2015	Kavli Institute for Brain and Mind Innovative Research Grant, Finding parallels: the role of the subiculum in neural encoding of object-environment alignment. Co-Investigator; PI: D. Nitz and J. Olson. \$50,000.
2015	Alfred P. Sloan Research Fellow in Neuroscience. \$50,000.
2014	UCSD Qualcomm Institute (QI), California Institute for Telecommunications and Information Technology (Calit2) Strategic Research Opportunities (CSRO) program. \$50,000.
2012	Feldman Family Foundation. Post-doctoral researcher; PI: A. Gazzaley \$15,000.
2012	University of California, San Francisco. Information Technology Innovation Contest: Disseminating UCSF Research & Connecting with Disease Communities via Social Media Automation, \$10,000.
2011–2014	National Institute of General Medical Sciences, NIH. Institutional Research and Career Development Award (IRACDA) Scholars in Science (ISIS). Mentor: A. Gazzaley. ~\$300,000.
2008–2010	National Institute of Neurological Disorders and Stroke, NIH. Diversity Supplement to NS021135: Attention, Orientation and Human Prefrontal Cortex. Graduate student researcher; PI: R.T. Knight. \$122,988.
2007	Course Improvement Grant: UC Berkeley IB 245L: Functional Neuroanatomy \$300.

## Academic mentorship

### Current

### **Post-doctoral researchers**

2019–	Natalie Schaworonkow: Postdoctoral researcher, UC San Diego
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### **Graduate students**

- 2020– Eena Kosik: PhD Student, Cognitive Science, UC San Diego
- 2020– Quirine van Engan: PhD Student, Cognitive Science, UC San Diego
- 2020– Sydney Smith: PhD Student, Neuroscience, UC San Diego
- 2019– Tyler Farnan: Masters Student, Computational Science, Mathematics, and Engineering, UC San Diego
- 2014– Thomas Donoghue: PhD Student, Cognitive Science, UC San Diego
- **Awards:** Cognitive Neuroscience Society Graduate Student Award
- 2014– Richard Gao: PhD Student, Cognitive Science, UC San Diego
- **Awards:** Natural Sciences & Engineering Research Council of Canada Postgraduate Scholarship-Doctoral; UCSD Frontiers of Innovation Scholars Program; Computational and Systems Neuroscience (Cosyne) New Attendee Travel Award, UCSD Summer Graduate Teaching Scholarship

### **Undergraduate researchers**

- 2020– Lulu Ricketts: Cognitive Science-Machine Learning, UC San Diego
- 2020– Valentina Carreno: Cognitive Science-Design, UC San Diego
- 2020– Chase Oden: Data Science, UC San Diego
- 2020– Shuangquan Feng: Cognitive Science-Machine Learning/Mathematics-Computer Science, UC San Diego
- 2019–2020 Fenglin Zhang: Cognitive Science-Machine Learning/Mathematics, UC San Diego

### **Dissertation committee**

- 2020– Julian Kosciessa: Douglas Garrett, Psychiatry and Ageing Research, Max Planck Institute for Human Development, Berlin, Germany
- 2020– Sean Kross: Philip Guo, UC San Diego, Cognitive Science
- 2020– Christian Cazares: Tina Gremel, UC San Diego, Psychology
- 2019– Michael Turvey: Tim Gentner, UC San Diego, Psychology
- 2019– Robert Loughnan: Terry Jernigan, UC San Diego, Cognitive Science
- 2019– Margaret Henderson: John Serences, UC San Diego, Neuroscience
- 2020– Ian Drosos: Philip Guo, UC San Diego, Cognitive Science
- 2018– Michael Metke: Cory Miller, UC San Diego, Psychology
- 2018– Michael Allen: David Kirsch, UC San Diego, Cognitive Science
- 2018– Daril Brown: Vikash Gilja, UC San Diego, Electrical Engineering
- 2018– Sunandha Srikanth: Stefan Leutgeb, UC San Diego, Biology
- 2018– Anna Mai: Erik Bakovic, UC San Diego, Linguistics
- 2017– Sasen Cain: Tim Gentner, UC San Diego, Psychology
- 2016– Thomas Gillespie: Maryann Martone, UC San Diego, Neuroscience
- 2016– Matthew Piper: Rick Grush: UC San Diego, Philosophy
- 2015– Vladimir Jovanovic: Cory Miller, UC San Diego, Neuroscience

### **Past**

### **Post-doctoral researchers**

- 2019–2020 Stéphanie Martin: UC San Diego
- **Awards:** Halicioğlu Data Science Institute Post-doctoral Data Science Fellow, UC San Diego
  - **Current:** Research Scientist, X Development (Google X)
- 2015–2017 Roemer van der Meij: UC San Diego
- 2014–2017 Erik Peterson: UC San Diego
- **Current:** Machine Learning Scientist, Carnegie-Mellon University

### **Graduate students**

- 2015–2019 Tammy Tran: PhD Student, Neuroscience, UC San Diego
- **Awards:** UCSD-NIH Institute for Neural Computation Training Program in Cognitive Neurosciences; Kavli Institute for Brain and Mind Innovative Research Grant; UCSD Achievement Rewards for College Scientists
  - **Thesis:** On the impact of neural variability on healthy aging and memory
  - **Current:** Scientific Analyst, Morrison & Foerster
- 2015–2018 Scott Cole: PhD Student, Neuroscience, UC San Diego
- **Awards:** NSF Graduate Research Fellowship; UCSD Frontiers of Innovation Scholars Program
  - **Thesis:** On the waveform shape of neural oscillations
  - **Current:** Data Scientist, Samba TV
- 2015 Anwaya Aras: MS Student, Computer Science, UC San Diego
- **Thesis:** Algorithmic mining of neural-genetic functional relationships
  - **Current:** Software Engineer, Uber, Inc.

### **Staff**

- 2020– Ryan Hammonds: Applications Programmer, UC San Diego
- 2018–2019 Sydney Smith: Lab Manager
- **Current:** Neurosciences PhD student, UC San Diego
- 2014–2016 Torben Noto: Lab Manager
- **Current:** Neurosciences PhD student, Northwestern University

### **Visiting faculty**

- 2015–2016 Brad Postle: Visiting Professor, University of Wisconsin-Madison

### **Visiting student researchers**

- 2019–2020 Jaap van der Aar: Ramsey Lab, University of Utrecht
- **Current:** PhD student, Technical University Eindhoven, Netherlands
- 2019 Nick Fisher: Summer Training Academy for Research Success (STARS), UC San Diego
- 2019 Jairo Chavez: Summer Training Academy for Research Success (STARS), UC San Diego
- 2018–2019 Quirine van Engen: Pennartz Lab, University of Amsterdam

- **Current:** Neurosciences PhD student, UC San Diego
- 2017 & 2018 Leonhard Waschke: Obleser Lab, University of Lübeck
- **Current:** Postdoctoral Fellow, Max Planck Institute for Human Development
- 2017 Simin Berend: Enriquez-Geppert Lab, University of Groningen
- 2017 Rifqi Affan: NIH Maximizing Access to Research Careers (MARC), UC San Diego
- **Current:** Neurosciences PhD student, Boston University
- 2015 Scott Susi: Summer Training Academy for Research Success (STARS), UC San Diego
- **Current:** Neurosciences PhD student, Brown University

### ***Undergraduate researchers***

- 2019–2020 Meyhaa Buvaresh: Cognitive Science-Machine Learning, UC San Diego
- 2019–2020 Lakshmi Menon: Cognitive Science-Machine Learning, UC San Diego
  - **Awards:** DeepMind Fellow, NYU Center for Data Science
- 2019–2020 Adrianna Hohil: Cognitive Science-Machine Learning, UC San Diego
- 2018–2020 Tianyu Zhang: Cognitive Science-Machine Learning/Mathematics, UC San Diego
- 2018–2020 Geeling Chau: Cognitive & Behavioral Neuro/Comp Engineering, UC San Diego
  - **Awards:** Halicioğlu Data Science Institute Scholarship, UC San Diego
- 2018–2020 Jairo Chavez: Cognitive Science-Machine Learning, UC San Diego
  - **Awards:** Halicioğlu Data Science Institute Scholarship, UC San Diego
- 2018–2020 Sashaank Pasumarthi: Computer Science and Engineering, UC San Diego
  - **Awards:** Halicioğlu Data Science Institute Scholarship, UC San Diego
- 2018–2020 Michael Tran: Cognitive Science-Machine Learning, UC San Diego
- 2018–2020 Julio Dominguez: Cognitive Science-Machine Learning, UC San Diego
  - **Awards:** UCSD Triton Research and Experiential Learning Scholarship (TRELS)
- 2016–2019 Luyanda Mdanda: Cognitive Science-Machine Learning, UC San Diego
  - **Awards:** Halicioğlu Data Science Institute Scholarship, UC San Diego; Generation Google Scholarship
- 2017–2019 Jenny Hamer: Mathematics-Computer Science, UC San Diego
- 2018 Dylan Christiano: Cognitive Science-Machine Learning, UC San Diego
- 2018 Sitan Liu: Mathematics-Computer Science, UC San Diego
- 2017–2018 Grant Sheagley: Cognitive Science, UC San Diego
- 2017–2018 Andrew Washington: Cognitive Science-Machine Learning, UC San Diego
  - **Awards:** UCSD Chancellor's Research Excellence Scholarship
- 2016–2018 Lauren Liao: Probability and Statistics, UC San Diego
  - **Awards:** Halicioğlu Data Science Institute Scholarship, UC San Diego; UCSD Chancellor's Research Excellence Scholarship; Fields Undergraduate Summer Research Program (FUSRP), University of Toronto
- 2016–2018 Priyadarshini Sebastian: Applied Math and Cognitive Science, UC San Diego
  - **Awards:** UCSD Frontiers of Innovation Scholars Program

- 2016–2018 Yimeng Yang: Computer Science and Engineering, UC San Diego  
 2015–2018 Erin D. Cole: Computer Science and Engineering, UC San Diego  
     • **Awards:** Mozilla Open Leader; UCSD Science and Engineering Undergraduate Research Scholarship  
 2017 Tanner Turner: Applied Math, UC San Diego  
 2015–2017 Simon Haxby: Applied Math, UC San Diego  
 2015–2017 Liz Izhikevich: Computer Science and Engineering, UC San Diego  
     • **Awards:** UCSD Warren College Undergraduate Research Scholarship; UCSD Ledell Endowed Research Scholarship for Science and Engineering  
 2007–2009 Sara LaHue: Neurobiology, UC Berkeley  
 2008–2009 Lisa Tseng: Neurobiology, UC Berkeley

### **Dissertation committee**

- 2017–2020 Ladan Moheimanian: Gerwin Schalk, Wadsworth Center  
 2019 Oscar Christian González: Maxim Bazhenov, UC San Diego, Neuroscience  
 2015–2019 Lauren Curley: Terry Jernigan, UC San Diego, Cognitive Science  
 2015–2019 Stephanie Nelli: John Serences, UC San Diego, Neuroscience  
 2018 Mainak Jas: Alexandre Gramfort, Inria, Université Paris-Saclay  
 2015–2018 Xi Jiang: Eric Halgren, UC San Diego, Neuroscience  
 2016–2018 Adam Rule: Jim Hollan, UC San Diego, Cognitive Science  
 2015–2018 Erik Kaestner: Eric Halgren - UC San Diego, Neuroscience  
 2015–2017 Adriana de Pestors: Gerwin Schalk, Wadsworth Center  
 2015–2017 Akinyinka Omigbodun: Vikash Gilja, UC San Diego, Electrical Engineering  
 2015–2017 Marybel Gonzalez: Terry Jernigan, UC San Diego, Cognitive Science  
 2015–2020 Robert Gougelet: PhD Student, Cognitive Science, UC San Diego  
 2014–2017 Mary E. Smith: John Serences, UC San Diego, Psychology

## **Teaching**

### **Instructor of record**

- 2020 (winter) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 308)  
     • **TAs:** Tzu-Han Cheng, Shuai Tang  
     • **Student evaluation:** course (94%), instructor (95%)  
 2019 (fall) COGS 108: Data Science in Practice, UC San Diego (enrollment: 434)  
     • **TAs:** Akshansh Chahal, Samuel Lau, Enlin Wei  
     • **Student evaluation:** course (94%), instructor (96%)  
 2018 (fall) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 404)  
     • **TAs:** Richard Gao, Robert Gougelet, Tim Tadros  
     • **Student evaluation:** course (91%), instructor (95%)  
 2018 (fall) COGS 280: Neural Oscillations, UC San Diego  
 2017 (winter) COGS 108: Data Science in Practice, UC San Diego (enrollment: 426)  
     • **TAs:** Thomas Donoghue, Shuai Tang  
     • **Student evaluation:** course (91%), instructor (98%)  
 2017 (fall) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 200)

- **TAs:** Lauren Curley, Sakshi Gupta
  - **Student evaluation:** course (93%), instructor (98%)
- 2017 (spring) COGS 108: Data Science in Practice, UC San Diego (enrollment: 401)
- New course, first offering (co-developed with Thomas Donoghue)
  - **TAs:** Thomas Donoghue, Harshita Mangal, Larry Muhlstein
  - **Student evaluation:** course (87%), instructor (94%)
- 2016 (fall) COGS 1: Introduction to Cognitive Science, UC San Diego (enrollment: 483)
- Significantly updated course to move to fewer guest lectures and more comprehensive overview
  - **TAs:** Richard Gao, Reina Mizrahi, Eric Morgan
  - **Student evaluation:** course (94%), instructor (96%)
- 2016 (fall) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 245)
- **TAs:** Lauren Curley, Sakshi Gupta
  - **Student evaluation:** course (88%), instructor (97%)
- 2016 (spring) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 99)
- **TA:** Robert Gougelet
  - **Student evaluation:** course (97%), instructor (97%)
- 2016 (spring) COGS 260 / NEU 221: Neural Oscillations, UC San Diego
- 2015 (fall) COGS 1: Introduction to Cognitive Science, UC San Diego (enrollment: 333)
- **TAs:** Eunice Lim, Arthur Semenyuk
  - **Student evaluation:** course (91%), instructor (97%)
- 2015 (fall) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 48)
- **TA:** Thomas Donoghue
  - **Student evaluation:** course (100%), instructor (100%)
- 2015 (fall) NEU 221: Communicating Science, UC San Diego
- New graduate course, first offering (co-developed with Kelsey Ladit)
- 2015 (spring) COGS 3: Introduction to Computation, UC San Diego (enrollment: 91)
- Significantly updated course to move to Python and shell script
  - **TA:** Thomas Donoghue
  - **Student evaluation:** course (95%), instructor (92%)
- 2015 (spring) COGS 260 / NEU 221: Neural Oscillations, UC San Diego
- New graduate course, first offering
- 2014 (fall) COGS 9: Introduction to Data Science, UC San Diego (enrollment: 24)
- New course, first offering
  - **Student evaluation:** course (100%), instructor (100%)

## Development

2013 (spring) Teaching Workshop Series, NIH-IRACDA, UC San Francisco / San Francisco State University

## Graduate student teaching

2008 (spring) IB 245: Functional Neuroanatomy, UC Berkeley

- **Faculty:** Marion Diamond
- **Student evaluation:** graduate instructor (6.94/7.00)

2007 (spring) IB 245: Functional Neuroanatomy, UC Berkeley

- **Faculty:** Marion Diamond
  - **Student evaluation:** graduate instructor (6.80/7.00)
- 2005 (fall)      MCB 163: Mammalian Neuroanatomy, UC Berkeley
- **Faculty:** Jeffrey Winer
  - **Student evaluation:** graduate instructor (6.65/7.00)

## Scientific tool development

**fooof** — fitting oscillations and one-over-f ([link](#)): fooof is a fast, efficient, and physiologically-informed tool to parameterize neural power spectra.

**bicycle** — cycle-by-cycle waveform parameterization ([link](#)): bicycle parameterizes features of neural oscillations in the time domain.

**neurodsp** — neuro digital signal processing ([link](#)): neurodsp is package of tools to analyze and simulate neural time series.

**brainSCANr** — brain systems, connections, associations, and network relationship engine: brainSCANr is a tool to visually examine the relationships between brain regions, functions, and diseases. (defunct)

## Service

### Academic

- 2020–      Vice-chair: Data Science Major/Minor Steering Committee, UC San Diego
- 2019      Organizing committee co-chair: IEEE 25th SIGKDD Conference on Knowledge Discovery and Data Mining, Applied Data Science Panel
- 2019–      Industry liaison committee: Halicioğlu Data Science Institute, UC San Diego
- 2019–      Data Science Major Committee: Halicioğlu Data Science Institute, UC San Diego
- 2019–      Faculty Advocate: PATHways to STEM, UC San Diego
- 2019–2020      Diversity Representative: UC San Diego, Halicioğlu Data Science Institute
- 2018–      Director: Halicioğlu Data Science Institute Undergraduate Scholarship Program, UC San Diego
- 2018–2020      Director: Halicioğlu Data Science Institute Distinguished Lecture Series, UC San Diego
- 2017–      Diversity Outreach and Training Committee founder and board member: Cognitive Neuroscience Society
- 2017–      Executive Committee: Neurosciences Graduate Program, UC San Diego
- 2017–      Executive Committee: Halicioğlu Data Science Institute, UC San Diego
- 2016–2019      Diversity Committee Chair: Neurosciences Graduate Program, UC San Diego
- 2015–2019      PhD admissions committee: Neurosciences Graduate Program, UC San Diego
- 2018      Committee chair: National Academy of Sciences, Kavli Frontiers of Science
- 2015–2017      Committee member: National Academy of Sciences, Kavli Frontiers of Science
- 2015      PhD admissions committee: Department of Cognitive Science, UC San Diego
- 2015–      Faculty Representative: Data Science Student Society (DS3), UC San Diego
- 2015–2017      Academic Senate Representative (elected): John Muir College, UC San Diego
- 2015      Invitee: NIH/CSHL Banbury Meeting, Brain Rhythms as Potential Targets for Intervention in Cognitive Dysfunctions

2014–2016	Diversity Representative: Neurosciences Graduate Program, UC San Diego
2014–2017	Faculty Representative: Cognitive Science Student Association, UC San Diego
2014–2017	Diversity Representative: Department of Cognitive Science, UC San Diego
2006–2007	Graduate Assembly Delegate: Helen Wills Neuroscience Institute, UC Berkeley
2006–2007	Representative: Committee on Educational Policy, UC Berkeley
2006–2007	Technology Chair: Graduate Assembly Executive Board, UC Berkeley

## **Grants**

2020	Special Emphasis Panel reviewer: National Institutes of Health (NIH), National Institute of Neurological Disorders and Stroke (NINDS)
2019–2020	Reviewer: Veterans Affairs (VA) Office of Research and Development, Neurobiology subcommittee

## **Scientific grant review (*ad hoc*)**

National Science Foundation CAREER; The Netherlands Organisation for Scientific Research (NWO, the Dutch Research Council) Vici programme; Israel Science Foundation (ISF); John Templeton Foundation

## **Scientific peer review (*ad hoc*)**

Addiction Biology, Annals of Neurology; Biological Psychiatry; Brain; Brain and Cognition; Brain Research; Cerebral Cortex; Cognitive, Affective, and Behavioral Neuroscience; eLife; eNeuro; European Journal of Neuroscience; Frontiers in Computational Neuroscience; Frontiers in Human Neuroscience; Human Brain Mapping; Journal of Cognitive Neuroscience; Journal of Neurophysiology; Journal of Neuroscience; Journal of Neuroscience Methods; Nature; Nature Communications; Nature Neuroscience; Neural Computation; Neurobiology of Aging; NeuroImage; Neuron; Neurology; Neuroscience Letters; PLoS Computational Biology; PLOS ONE; PLOS Computational Biology; The Proceedings of the National Academy of Sciences USA; Trends in Neurosciences

## **Scientific conference review (*ad hoc*)**

2018 Conference on Cognitive Computational Neuroscience (CCN 2018), 2019 Conference on Cognitive Computational Neuroscience (CCN 2019)

## **Scientific book review (*ad hoc*)**

John Wiley & Sons; MIT Press

## **Professional societies**

2017	Society for Neuroscience: Invited Panelist, Professional Development Workshop: A Practical Guide to Science Communication
2015	Society for Neuroscience: Invited Panelist, Exploring New Communications Channels: Science Blogging
2013	Society for Neuroscience: Invited Panelist, Careers Beyond the Bench
2013–2016	Blogger “Brain Metrics”, Nature Publishing Group, Nature Education: Scitable
2012–2016	Blogger, BrainFacts.org: public information initiative of The Kavli Foundation, the

Gatsby Charitable Foundation, and the Society for Neuroscience  
2006 San Francisco Bay Area Society for Neuroscience Chapter: Organizer, Brain  
Awareness Week

## Media coverage

### Book appearances

1. Me, Myself, and Why: Searching for the Science of Self, Jennifer Ouellette, 2014 Jan. (interview)
2. The Data Science Handbook: Advice and Insights from 25 Amazing Data Scientists, Shang, Wang, Chen, and Song, 2015 May. (dedicated chapter profile)

### Public outreach/science communication

1. The Huffington Post, "Neuroscience on Twitter: 30 High-Profile Scientists who Tweet", 2012 Jun. ([link](#))
2. Chicago Tribune, "Feel like you're faking it? That might not be a bad thing", 2012 Jul. ([link](#))
3. Wired, "Pseudoscience Saps the Power of the TEDx Brand", 2012 Dec. ([link](#))
4. Inc Magazine, "When Passion for Work Is a Bad Thing", 2014 Mar. ([link](#))
5. FastCompany, "How to Stop Feeling Like a Fraud", 2014 Mar. ([link](#))
6. Nature, "Laboratory careers: Catalysts for efficient science", 2014 Jun. ([link](#))
7. livescience, "Scientists' Resolutions for 2015", 2014 Dec. ([link](#))
8. Del Mar Times, "Scientist's words resonate with Torrey Pines High students: Listen to, support each other", 2015 Mar. ([link](#))
9. Scientific American, "Scientists: Advertise Your Failures!", 2017 Sep. ([link](#))
10. Psychology Today, "Mistaking the Highlight Reel for the Game", 2018 Nov. ([link](#))
11. College Contact, "Die UC San Diego im Interview", 2019 Jan. ([link](#))
12. Cognitive Revolution with Cody Kommers, "Bradley Voytek on Being a F\*\*k up with Potential", 2019 Dec. ([link](#))

### Neuroscience

1. The New York Times, "In Pursuit of a Mind Map, Slice by Slice", 2010 Dec. ([link](#))
2. The Washington Post, "Brain Trauma and Rehabilitation", 2011 Jan. ([link](#))
3. Forbes, "Why Uber's Data Fascinates a Neuroscientist", 2012 Mar. ([link](#))
4. Forbes, "The Story Of A Neuroscientist, A Car Service And Location Data", 2012 Mar. ([link](#))
5. Big Picture Science, "Wired for Thought", 2012 Jan. ([link](#))
6. Forbes, "Do Liars Really Have Different Brains?", 2012 Jun. ([link](#))
7. Vice Magazine, "Blinking Prosthetics and a Better Robocop: Neural Interfacing Tech Is Booming", 2012 Oct. ([link](#))
8. ScienceNews, "Global neuro lab", 2013 Nov. ([link](#))
9. Discover, "What's on Your Mind?", 2014 Mar.
10. Business Insider, "Why We're Constantly Losing Brain Cells", 2014 Mar. ([link](#))
11. The Atlantic, "Things You Cannot Unsee (And What That Says About Your Brain)", 2014 May. ([link](#))



12. The New York Times, "Clues to How an Electric Treatment for Parkinson's Works", 2015 Apr. ([link](#))
13. Wired, "Bradley Voytek on Oliver Sacks' 'Soft Thinking'", 2015 Sep. ([link](#))
14. Gizmodo, "New Study Casts More Doubt on Notion of the Brain's 'Pain Matrix'", 2016 Apr. ([link](#))
15. The New York Times, "'Pacemaker' for the Brain Can Help Memory, Study Finds", 2017 Apr. ([link](#))
16. NPR, "In Memory Training Smackdown, One Method Dominates", 2017 Oct. ([link](#))
17. The New York Times, "To Improve Memory, Tune It Like an Orchestra", 2019 Apr. ([link](#))

## Data Science

1. Forbes, "Neuroscientist Bradley Voytek is Bringing the Silicon Valley Ethos into Academia", 2011 Oct. ([link](#))
2. Strata, "Why Uber's Data Fascinates a Neuroscientist", 2012 Mar. ([link](#))
3. Reuters, "Chart of the day, party neighborhood edition", 2012 Sep. ([link](#))
4. Mountain View Voice, "In data analysis, details matter", 2013 Mar. ([link](#))
5. The New York Times, "Attention, Shoppers: Store Is Tracking Your Cell", 2013 Jul. ([link](#))
6. Mashable, "Shutdown Silver Lining: Less Traffic for D.C." 2013 Nov. ([link](#))
7. The Inquisitr, "Government Shutdown Solved One Problem: Washington D.C. Traffic". 2013 Nov. ([link](#))
8. The Independent, "The number crunch: Will Big Data transform your life - or make it a misery?", 2014 Jan. ([link](#))
9. The New York Times, "With Uber, Less Reason to Own a Car". 2014 Jun. ([link](#))
10. VentureBeat, "Uber simulated a city to teach drivers how to optimize their earnings". 2014 Aug. ([link](#))
11. The Economist, "Automated hypothesis generation: Computer says 'try this'", 2014 Oct. ([link](#))

## Zombies

1. National Geographic TV, "The Truth Behind Zombies", 2010 Oct.
2. Wired, "How to Survive the Zombie Apocalypse Using Science", 2011 Jun. ([link](#))
3. Mind Hacks, "The neurology of the undead", 2011 Jun. ([link](#))
4. El Mundo, "Neurociencia contra los zombies", 2011 Jul. ([link](#))
5. American Academy of Neurology, interviewed in Neurology Now, "Two Self-Proclaimed Neuroscience 'Geeks' Decipher the Zombie Brain", 11(15), 32-34, 2011 Aug. ([link](#))
6. Wired, "Zombie Brains: Fake Ghoul Science From a Real Scientist", 2011 Aug. ([link](#))
7. Forbes, "Explaining the Neuroscience of the Zombie Epidemic", 2011 Oct. ([link](#))
8. Slate, "Zombies Attack Science", 2011 Oct. ([link](#))
9. NPR, "Bay Area Science Festival Kicks Off with a Few Important Tips On Zombies", 2011 Oct. ([link](#))
10. NPR, "Bay Area Science Festival", 2011 Oct.
11. New York Magazine, "How to Survive a Zombie Attack", 2011 Oct. ([link](#))

12. New Hampshire Public Radio, "Of Zombie and Ants", 2012 May. ([link](#))
13. The Washington Monthly, "Zombie Brains", 2012 Jul. ([link](#))
14. The Chronicle of Higher Education, "Zombies on the Brain: Young Neuroscientists' Popular Zombie Study Frightens Their Advisers Most of All", 2012 Jul. ([link](#))
15. TED Ed, "Diagnosing a zombie", 2012 Oct. Part 1 ([link](#)); Part 2 ([link](#))
16. The Columbus Dispatch, "The science (fiction) of zombies", 2012 Oct. ([link](#))
17. Wired, "Zombie Neuroscientist Explains the Ant-Like Behavior of World War Z's Running Dead", 2012 Nov. ([link](#))
18. Wired, "A Pseudo-Scientific Analysis of Warm Bodies and the Zombie Tropes It Defies", 2013 Jan. ([link](#))
19. Slate, "What Don't People Do in Zombie Apocalypse Movies That You Would Do?", 2013 Jul. ([link](#))
20. Image Comics, "The Walking Dead 100 Project" neuroscience primer. 2013 Sep.
21. livescience, "'The Walking Dead': How to Survive a Zombie Invasion", 2013 Oct. ([link](#))
22. livescience, "Zombie Neuroscience: Inside the Brains of the Walking Dead", 2013 Oct. ([link](#))
23. U-T San Diego, "UCSD recruits expert on zombies", 2014 Apr. ([link](#))
24. World Science Festival, Smart Reads: Bradley Voytek's 'Do Zombies Dream Of Undead Sheep?', 2014 Sep. ([link](#))
25. NPR/KPBS, "UCSD Professor Uses Zombies To Teach About Neuroscience", 2014 Oct. ([link](#))
26. NPR/KPBS, "Zombies Versus Real Science: Which Is Scariest?", 2014 Oct. ([link](#))
27. U-T San Diego, "Inside the brain of a zombie", 2014 Oct. ([link](#))
28. Slate, "Why do zombies lumber?", 2014 Oct. ([link](#))
29. Aeon, "The good zombie", 2014 Nov. ([link](#))
30. The Daily Mail, "The science of ZOMBIES", 2014 Dec. ([link](#))
31. Die Welt, "Why a zombie just can not think clearly", 2015 Jan. ([link](#))
32. Pittsburgh Post-Gazette, "Headaches of the Walking Dead: 'Do Zombies Dream of Undead Sheep? A Neuroscientific View of the Zombie Brain'", 2015 Feb. ([link](#))
33. Five Books, "Bradley Voytek on Surrealism and the Brain", 2015 Feb. ([link](#))
34. ABC (Australian Broadcasting Corporation) All in the Mind, "Braaaaaains: What the zombie mind teaches us about neuroscience", 2016 Apr. ([link](#))
35. Daily Mail, "How to survive a zombie apocalypse", 2016 May. ([link](#))
36. Popular Mechanics, 'Game of Thrones' Science: How Do Wights Work?, 2019 Apr. ([link](#))

## Invited lectures

### Public outreach/science communication

1. Girl Scouts of Northern California Girls Go Tech, San Francisco, CA, USA. 2006 Feb.
2. Brain Awareness Week organizer, San Francisco Bay Area chapter of the Society for Neuroscience, Berkeley, CA, USA. 2006 Mar.
3. Girl Scouts of Northern California Girls Go Tech, San Francisco, CA, USA. 2007 Feb.
4. Anthony W. Ochoa Intermediate School Youth Enrichment Program, Hayward, CA, USA. 2007 Jun.

5. The Tech Museum of Innovation Body Worlds 2, San Jose, CA, USA. 2007 Oct.
6. Girl Scouts of Northern California Girls Go Tech, San Francisco, CA, USA. 2008 Feb.
7. Girl Scouts of Northern California Girls Go Tech, San Francisco, CA, USA. 2009 Feb.
8. Allendale Elementary School Mind & Brain Night, Oakland, CA, USA. 2009 Feb.
9. International Conference on the Fantastic in the Arts, Orlando, FL, USA. 2011 Mar.  
Reviewed abstract: "Breach in the mind: The hypothetical neuroanatomy subserving the process of 'unseeing' in China Miéville's *The City & The City*"
10. ScienceOnline Bay Area, swissnex, Social Media for Science Outreach, San Francisco, CA, USA. 2012 May.
11. swissnex, San Francisco, CA, USA. 2012 May.
12. UCSF Center for Educational Partnerships, National Youth Leadership Forum, San Francisco, CA, USA. 2012 Jul.
13. NASA Ames Research Center, Social Media for Science Outreach, Mountain View, CA, USA. 2012 Jul.
14. Big Picture Science, Bay Area Science Festival, Computer History Museum, Mountain View, CA, USA. 2012 Oct.
15. Stanford University, Neuroscience PhD Program, Professional Development Program, Stanford, CA, USA. 2013 Jan.
16. UC San Francisco, Recruitment Fair, CA, USA. 2013 Jan.
17. UC Berkeley, Careers Beyond Academia conference, Berkeley, CA, USA. 2013 Mar.
18. UC San Diego, Family Weekend, CA, USA. 2014 Oct.
19. TEDxSanDiego, San Diego, CA, USA. 2014 Nov.
20. UC San Diego, Social Sciences Supper Club, CA, USA. 2014 Nov.
21. Torrey Pines High School, La Jolla, CA, USA. 2014 Dec.
22. High Tech Middle School, San Diego, CA, USA. 2015 Jan.
23. Los Angeles Brain Bee, UC Irvine, CA, USA. 2015 Feb.
24. High Tech High School, San Diego, CA, USA. 2015 Mar.
25. Torrey Pines High School, La Jolla, CA, USA. 2015 Mar.
26. UC San Diego, "Social Media for Campus Researchers and Faculty". 2015 Apr.
27. Clarion Workshop, UC San Diego, CA, USA. 2015 Jul.
28. City of Hope, Eugene and Ruth Roberts Summer Student Academy, Duarte, CA, USA. 2015 Jul.
29. Rueben H. Fleet Science Center, Adult Lecture Series, San Diego, CA, USA. 2016 Mar.
30. Pacific Ridge School, Carlsbad, CA, USA. 2016 Mar.
31. San Diego State University, Graduate Student Symposium, CA, USA. 2016 Apr.  
(keynote)
32. Chancellor's Associates Scholars Program, UC San Diego, CA, USA. 2016 Jul. (keynote)
33. Osher Lifelong Learning Institute at UC San Diego, CA, USA. 2016 Sep.
34. San Diego Independent Scholars, La Jolla, CA, USA. 2016 Sep.
35. The Communicating Science Workshop, La Jolla, CA, USA. 2016 Sep. (keynote)
36. Pacific Ridge School, Carlsbad, CA, USA. 2017 Mar.
37. Community College Symposium, UC San Diego, CA, USA. 2017 May. (keynote)

38. Frontiers of Innovation Scholars Program Symposium, UC San Diego, CA, USA. 2017 Oct. (keynote)
39. Pacific Ridge School, Carlsbad, CA, USA. 2018 Apr.
40. PATHS Scholars luncheon, UC San Diego, CA, USA. 2019 Feb.
41. Campus Community Conference: Establishing Community, UC San Diego, CA, USA. 2019 Feb. (keynote)
42. Chancellor's Associates, UC San Diego, CA, USA. 2019 Jun.
43. UCSF IRACDA Scholars Program Career panel, San Francisco, CA, USA. 2019 Nov.
44. Pacific Ridge School, Carlsbad, CA, USA. 2020 Mar.

## Neuroscience

1. UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2005 May.
2. UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2006 Apr.
3. UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2006 Nov.
4. UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2007 Apr.
5. Neural Information Processing Systems: Large Scale Brain Dynamics Workshop, Vancouver, BC, Canada. 2007 Dec.
6. UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2008 Apr.
7. IEEE/UC Berkeley Cognitive Science Student Association, Berkeley, CA, USA. 2009 Mar.
8. California Cognitive Science Conference, Berkeley, CA, USA. 2009 Apr.
9. Rikshospitalet University Hospital, Oslo, Norway. 2009 May.
10. Max-Planck-Institut für Kognitions- und Neurowissenschaften, Leipzig, Germany. 2009 Aug.
11. University of Oregon, Department of Psychology, Eugene, OR, USA. 2009 Nov.
12. IEEE/UC Berkeley CS/EE Demo Day, Berkeley, CA, USA. 2010 Apr.
13. Bay Area Memory Meeting, Stanford, CA, USA. 2010 Aug.
14. University of California, Davis, Center for Mind and Brain: Time-Frequency Bootcamp, "Advanced Time-Frequency Analysis Methods", Davis, CA, USA. 2010 Aug.
15. UC Berkeley, Cognition, Brain, and Behavior, Berkeley, CA, USA. 2010 Oct.
16. International Congress for Clinical Neurophysiology: Neuronal Oscillations in Multi-scale Brain Networks Workshop, Kobe, Japan. 2010 Oct.
17. University of Washington, College of Computer Science & Engineering, Seattle, WA, USA. 2010 Nov.
18. Computational and Systems Neuroscience: Developing Simplified Algebras to Describe Large-Scale Brain Dynamics Workshop, Salt Lake City, UT, USA. 2011 Feb.
19. DARPA "Narrative Networks (N2): The Neurobiology of Narratives Workshop", San Francisco, California, USA. 2011 Apr.
20. California Cognitive Science Conference, Berkeley, CA, USA. 2011 Apr.
21. Stanford University, Dept. of Neurology and Neurological Sciences, Stanford, CA, USA. 2011 May.
22. XI International Conference on Cognitive Neuroscience, Symposium Chair, "The Cognitive Role of Cross-frequency Coupling", Palma, Mallorca, Spain. 2011 Sep.

23. 3rd International Workshop on Advances in Electrocoricography, Washington, DC, USA. 2011 Nov.
24. UC Berkeley, Brain Imaging Center Research Day, Berkeley, CA, USA. 2011 Dec.
25. International Conference on the Fantastic in the Arts, Orlando, FL, USA. 2012 Mar.  
Reviewed abstract: "Medusa to Slake-moth: The Neurobiological Basis of Hypnagogia, Paralysis, Hallucinations, and Other Magical Abilities of Literary Monsters"
26. Annual Meeting of the San Francisco Neurological Society, Keynote Speaker, Sonoma, CA, USA. 2012 May.
27. Neuroscience Information Framework, 2012 May.
28. International Neuropsychological Society, Oslo, Norway. 2012 Jun.
29. Bay Area Memory Meeting, Davis, CA, USA. 2012 Aug.
30. Allen Brain Institute, Seattle, WA, USA. 2012 Aug.
31. UC Berkeley, CA, USA. 2012 Sep.
32. Stanford University, Dept. of Neurology and Neurological Sciences, Stanford, CA, USA. 2012 Sep.
33. University of Chicago, IL, USA. 2012 Oct.
34. UC San Francisco, Grand Rounds, CA, USA. 2013 Jan.
35. Stanford University, Neuroscience PhD Program, Stanford, CA, USA. 2014 Feb.
36. UC San Diego, Neuroscience Retreat, CA, USA. 2014 May.
37. UCLA, Computational Neuroscience Affinity Group, CA, USA. 2014 May.
38. UCLA, Learning and Memory Symposium, CA, USA. 2014 Jun.
39. UC San Diego, Cognitive Science Student Association Conference, CA, USA. 2014 Jun.
40. UCLA, Cognitive Science Conference, CA, USA. 2015 Apr. (keynote)
41. University of Pennsylvania, Computational Memory Lab, Philadelphia, PA, USA. 2015 Aug.
42. UC Merced; Mind, Technology, and Society Seminar, CA, USA. 2016 Jan.
43. UCLA, Integrative Center for Neural Repair, CA, USA. 2016 Mar.
44. Cognitive Neuroscience Society: The role of amplitude, phase, and rhythmicity of neural oscillations in top-down control of cognition Symposium, New York City, NY, USA. 2016 Apr.
45. Arizona State University, Neural Oscillations Conference, AZ, USA. 2016 May.
46. Computational Properties of the Prefrontal Cortex meeting, Lyon, France. 2016 Aug.
47. University of Southern California, Neuroimaging and Informatics seminar, CA, USA. Oct 2016.
48. Brown University, Neuroscience Seminar Series, Providence, RI, USA. 2017 Jan.
49. Stanford University, Center for Mind, Brain, and Computation seminar series. 2017 Feb.
50. Baylor College of Medicine, Core for Advanced MRI (CAMRI) seminar series. 2017 Mar.
51. Ernst Struengmann Forum, Manifestations and Mechanisms of Dynamic Brain Coordination over Development, Frankfurt, Germany. 2017 Mar.
52. UC San Diego, Lab Expo, CA, USA. 2018 Jan. (keynote)
53. UC Berkeley, Dept. of Molecular and Cellular Biology, Division of Neurobiology seminar. 2018 Apr.
54. UC Santa Barbara, Neuroscience Colloquium Series, CA, USA. 2018 May.

55. University of Pennsylvania, Mahoney Institute for Neurosciences Colloquium Series, Philadelphia, PA, USA. 2018 Oct.
56. 14rd International Workshop on Electrocorticography, San Diego, CA, USA. 2018 Nov.
57. American Society of Neurorehabilitation, San Diego, CA, USA. 2018 Nov. (keynote)
58. Society for Neuroscience, Nanosymposium Chair, "Network Interactions: Oscillations and Synchrony: EEG Studies", San Diego, CA, USA. 2018 Nov.
59. Nerd Nite San Diego, San Diego, CA, USA. 2019 May.
60. University of Texas at Austin, Neural Interface Initiative Seminar Series, Austin, TX, USA. 2019 May.
61. McGill University, Nonlinear Dynamics in Brain and Behaviour Symposium, Montreal, Quebec, Canada. 2019 Aug. (keynote)
62. The Scripps Research Institute / Salk Institute, Neurograd Symposium, CA, USA. 2020 Feb.
63. Gordon Research Conference, Bridging Neural Engineering and Neurobiology Edge Effects to Divergent Innovation, Ventura, CA, USA. 2020 Mar.
64. Yale University, Swartz Center for Theoretical Neuroscience seminar, New Haven, CT, USA. 2020 Apr.
65. Kavli Institutes in Neuroscience Forum, Yale University, New Haven, CT, USA. 2020 Apr.
66. UC San Diego, Neuroscience Retreat, CA, USA. 2020 May.
67. Diné College, NIH R25 URBRAIN—Undergraduate Readyng for Burgeoning Research for American Indian Neuroscientists, Tsale, Apache County, AZ, USA. 2020 Jun.
68. University of Illinois Urbana-Champaign, Cognitive Neuroscience Brown Bag, Champaign, IL, USA. 2020 Sep.
69. Society for Neuroscience, minisymposium speaker, "The logic of developing neocortical circuits in heath and disease", Washington, DC, USA. 2020 Oct.

## Data Science

1. AtGoogleTalks Tech Talk, Mountain View, CA, USA. 2010 Jan.
2. TEDxBerkeley, Berkeley, CA, USA. 2010 Apr.
3. SciFoo lecture, Mountain View, CA, USA. 2011 Aug.
4. Ignite at AndroidOpen, San Francisco, CA, USA. 2011 Oct.
5. In-Q-Tel CEO Summit, CA, USA. 2012 Feb.
6. Orange Institute, Palo Alto, CA, USA. 2012 Feb.
7. Splunk, San Francisco, California, USA. 2012 Mar.
8. Where Conference (O'Reilly Media) workshop, San Francisco, CA, USA. 2012 Apr.
9. Where Conference (O'Reilly Media) speaker, San Francisco, CA, USA. 2012 Apr.
10. Lookout, San Francisco, CA, USA. 2012 May.
11. Nerd Nite East Bay, Berkeley, CA, USA. 2012 Nov.
12. Hult International Business School, San Francisco, CA, USA. 2013 Jan.
13. The Hive, Palo Alto, CA, USA. 2013 Feb.
14. Strata, Santa Clara, CA, USA. 2013 Feb.
15. Kaggle, San Francisco, CA, USA. 2013 Mar.
16. BrightTALK, "Machine Learning: How to Make it Work in Your Organization". 2013 Jul.

17. General Assembly, San Francisco, CA, USA. 2013 Aug.
18. University of San Francisco, CA, USA. 2013 Oct.
19. PSFK, San Francisco, CA, USA. 2013 Nov.
20. Intuit, Mountain View, CA, USA. 2014 Feb.
21. Data Science for Sustainability, San Francisco, CA, USA. 2014 Aug.
22. Strata, New York, NY, USA. 2014 Oct.
23. Scripps Institution of Oceanography, Climate Science and Policy Program, La Jolla, CA, USA 2016 Aug.
24. Nerd Nite San Diego, San Diego, CA, USA. 2016 Sep.
25. Intuit, San Diego, CA, USA. 2018 Feb.
26. UC San Diego Halicioğlu Data Science Institute Inauguration, La Jolla, CA, USA 2018 Mar.
27. Smart Cities Acceleration Labs, San Diego, CA, USA 2018 Apr.
28. UC San Diego Neurosciences Graduate Program Career Panel, San Diego, CA, USA. 2018 May.
29. American Psychological Association, "Large-Scale Human Electrophysiology via Automated Parameterization of Neural Power Spectra." Talk. San Francisco , CA, USA. 2018 August.
30. American Psychological Association, "Novel Data Science Approaches to Examining Psychology." Symposium Chair. San Francisco, CA, USA. 2018 August.
31. UC San Diego, Computer Science & Engineering Society, 2019 Jan.
32. Teradata "TechVoice" presenter, San Diego, CA, USA. 2019 Feb.
33. Strata Data Conference, Technology Ethics Day, San Francisco, CA, USA. 2019 Mar.
34. Uber Science Symposium, San Francisco, CA, USA. 2019 May. (keynote)
35. Sapien Labs Symposium, "EEG: Analytical Approaches and Applications", 2019 Jun.
36. Qualcomm Data Science, San Diego, CA, USA. 2019 Jun.
37. Let's GO Data Science meetup, San Diego, CA, USA. 2019 Aug.
38. DataScienceGO, San Diego, CA, USA. 2019 Sep.
39. MLConf, San Francisco, CA, USA. 2019 Nov.
40. Cultured Data Symposium, San Diego, CA, USA. 2020 Feb.
41. USC Data Science Club, Los Angeles, CA, USA. 2020 Mar.
42. Data Science Distinguished Speaker Series and eScience Neuroinformatics Special Interest Group, University of Washington, Seattle, WA, USA. 2020 May.
43. Ignite Shelter-in-Place, virtual meeting. 2020 May.
44. DataScienceGO, virtual meeting. 2020 Jun.

## **Zombies**

1. zomBcon, Seattle, WA, USA. 2010 Oct.
  - Panelist: Plague Science
  - Speaker: Scanning the Zombie Brain
  - Panelist: Zombie Anatomy
2. San Francisco Nerd Nite, San Francisco, CA, USA. 2011 Jan.
3. Comic-Con International, San Diego, CA, USA. 2011 Jul.

- Panelist: History of the Modern Zombie
  - Panelist: Science of Zombies: Is a real-life zombie “virus” possible?
4. 2nd annual zomBcon, Seattle, WA, USA. 2011 Oct.
  5. NightLife, California Academy of Sciences/Bay Area Science Festival, San Francisco, CA, USA. 2011 Oct.
  6. Brentwood Public Library, Brentwood, CA, USA. 2012 May.
  7. Comic-Con International, San Diego, CA, USA. 2012 Jul.
  8. Antioch Library, Antioch, CA, USA. 2012 Aug.
  9. NightLife, California Academy of Sciences/Bay Area Science Festival, San Francisco, CA, USA. 2012 Oct.
  10. University of Wisconsin, 2012 Dec.
  11. McDaniel College, 2013 Apr.
  12. Comic-Con International, San Diego, CA, USA. 2013 Jul.
  13. San Diego State University, CA, USA. 2014 Apr.
  14. Westercon (Guest of Honor), Salt Lake City, UT, USA. 2014 Jun.
  15. Comic-Con International, San Diego, CA, USA. 2014 Jul.
    - Panelist: Zombie Myths and Misconceptions
    - Panelist: Nerdist Science Panel
  16. Skeptics Distinguished Science Lecture Series, Caltech, Pasadena, CA, USA. 2014 Oct.
  17. UC San Diego Neuroscience Retreat, CA, USA. 2015 May.
  18. UC San Diego California Bookstore Day, CA, USA. 2015 May.
  19. KPBS: Zombies 101, CA, USA. 2015 Jun.
  20. Academic Connections, CA, USA. 2015 Jul.
  21. Suds & Science, San Diego, CA, USA. 2015 Oct.
  22. Natural History Museum of Los Angeles County, Los Angeles, CA, USA. 2016 Jun.
  23. Trevor Day School, New York, NY, USA. 2016 Sep.
  24. Suds & Science, San Diego, CA, USA. 2016 Oct.
  25. Rueben H. Fleet Science Center Night of Science, San Diego, CA, USA. 2016 Oct.
  26. Taste of Science, San Diego, CA, USA. 2016 Apr.
  27. UC San Diego Library, San Diego, CA, USA. 2018 Oct.

## Conference abstracts

1. Simon SL, Berman S, Voytek BT, Dacey J, Ling W, London ED. Deficits in reasoning and correlated abnormalities of regional cerebral glucose metabolism in methamphetamine abusers. Cognitive Neuroscience Society, New York City, NY, USA (2003).
2. Simon SL, Berman S, Voytek BT, Dacey J, Ling W, London ED. Deficits on complex cognitive tasks and correlated regional cerebral glucose metabolism in methamphetamine abusers. Society for Neuroscience, New Orleans, LA, USA (2003).
3. Voytek BT, Berman S, Simon SL, Ling W, Hayashi K, London ED. Differences in regional brain function due to marijuana use by methamphetamine abusers. Society for Neuroscience, New Orleans, LA, USA (2003).



4. Voytek BT, Berman S, Simon SL, Ling W, London ED. Differences in cerebral metabolism but not cognitive performance due to marijuana use by methamphetamine abusers. College for Problems on Drug Dependence, San Juan, PR (2004).
5. London ED, Berman SM, Voytek BT, Simon SL, Monterosso JR, Geaga JA, Hong MS, Hayashi KM, Thompson PM, Mandelkern MA, Brody AL, Rawson RA, Ling W. Cerebral metabolic dysfunction and impaired vigilance in recently abstinent methamphetamine abusers. American College of Neuropsychopharmacology, San Juan, PR (2004).
6. London ED, Bartzokis G, Hassid BD, Payer D, Monterosso J, Voytek B. Greater age-related brain atrophy in methamphetamine abusers than in healthy comparison subjects. Society for Neuroscience, Washington, DC, USA (2005).
7. Fuhrmann Alpert G, Oga T, Swann NC, Voytek B, Knight RT. Increased motor network  $\gamma$ -band coherence during movement preparation predicts short reaction times: An EEG study. Society for Neuroscience, Washington, DC, USA (2005).
8. Bauer M, London ED, Berman SM, Rasgon N, Mandelkern MA, Voytek B, Whybrow PC. Regional cerebral metabolism and anxiety symptoms in bipolar depression: Effect of levothyroxine. American College of Neuropsychopharmacology, Waikoloa, HI, USA (2005).
9. Berman SM, Voytek B, Mandelkern MA, Hassid BD, Isaacson A, Monterosso J, Miotto K, Ling W, Woods R, London ED. Changes in regional cerebral metabolism during the initial month of abstinence from chronic methamphetamine abuse. Society for Neuroscience, Atlanta, GA, USA (2006).
10. Voytek B. The Girls Scouts of the USA's Girls Go Tech initiative: Partnership in neuroscience outreach and education. Society for Neuroscience, San Diego, CA, USA (2007).
11. Voytek B, Yago E, Barceló F, Knight RT. Flexible reorganization of function after unilateral frontal damage in humans. Society for Neuroscience, San Diego, CA, USA (2007).
12. Voytek B, Secundo L, Flinker A, Manley G, Knight RT. Comparing signals: Electroencephalography, electromyography, and electrocorticography. Bay Area Neuro Gathering (BANG): SfN Local Chapter Research Meeting, San Francisco, CA, USA (2008).
13. LaHue S, Voytek B, Knight RT. Effects of verbal working memory on visual attention. Psychology Undergraduate Research Conference, University of California, Los Angeles, Los Angeles, CA, USA (2008).
14. Tseng L, Voytek B, Knight RT. Effects of aging and frontal lesions on posterior visual working memory. Psychology Undergraduate Research Conference, University of California, Los Angeles, Los Angeles, CA, USA (2008).
15. Voytek B, Dam C, Yago E, Vogel E, and Knight RT. Flexible reorganization of human prefrontal cortex following stroke. International Conference on Cognitive Neuroscience X, Bodrum, Turkey (2008).
16. Secundo L, Adeen F, Voytek B, Chang E, Barbaro NM, Kirsch HE, Stiver S, Gean AD, Manley G, and Knight RT. Subdural electrocorticographic and epidural electromyographic recording for brain machine interface. International Conference on Cognitive Neuroscience X, Bodrum, Turkey (2008).

17. Voytek B, Secundo L, Bidet-Caulet A, Scabini D, Stiver S, Gean AD, Manley G, Knight RT. A new model for high spatial and temporal resolution in human electrophysiology: Decompressive craniectomy. Society for Neuroscience, Washington, DC, USA (2008).
18. Voytek B, Secundo L, Bidet-Caulet A, Scabini D, Stiver S, Gean AD, Manley G, Knight RT. A new model for high spatial and temporal resolution in human electrophysiology: Decompressive craniectomy. National Neurotrauma Society Symposium, Orlando, FL, USA (2008).
19. Voytek B, Vogel EK, Knight RT. Human working memory deficits and cognitive recovery after prefrontal or basal ganglia lesions. Society for Neuroscience, Chicago, IL, USA (2009).
20. Løvstad M, Funderud I, Lindgren M, Endestad T, Due-Tønnessen P, Meling T, Voytek B, Knight RT, Solbakk AK. Auditory novelty processing in patients with orbitofrontal or lateral prefrontal lesions: An event-related potential (ERP) study. The 20th Annual Rotman Research Institute Conference: The Frontal Lobes, Toronto, ON, Canada (2010).
21. Voytek B, Knight RT. Top-down memory deficits after unilateral prefrontal or basal ganglia lesions. The 20th Annual Rotman Research Institute Conference: The Frontal Lobes, Toronto, ON, Canada (2010).
22. Voytek B, Secundo L, Manley GT, Knight RT. Hemispherectomy: A new model for semi-invasive BMI. Fourth International BCI Meeting. Asilomar, Pacific Grove, CA, USA (2010).
23. Cano ME, Shestyuk A, Flinker A, Voytek B, Paz-Alonso PM, Parvizi J, Crone NE, Knight RT. High gamma hippocampal response from human iEEG recordings predicts covert memory retrieval. Society for Neuroscience, San Diego, CA, USA (2010).
24. Funderud I, Løvstad M, Lindgren M, Endestad T, Due-Tønnessen P, Meling T, Voytek B, Knight RT, Solbakk AK. Contingent negative variation in patients with orbitofrontal and lateral lesions in the prefrontal cortex. Society for Neuroscience, San Diego, CA, USA (2010).
25. Liu Y, Voytek B, Knight RT, Ding M. Prefrontal lesion impairs visual attention mechanisms. Society for Neuroscience, San Diego, CA, USA (2010).
26. Voytek B, LaHue S, Davis M, Tseng L, Knight RT. Oscillatory network dynamics in human working memory and attention. Society for Neuroscience, San Diego, CA, USA (2010).
27. Voytek JB, Voytek B. brainSCANr: Mapping Brain Structure, Function, and Disease Relationships with PubMed. Organization for Human Brain Mapping, Quebec City, QC, Canada (2011).
28. Voytek B, Knight RT. The Cognitive Role of Cross-frequency Coupling. International Conference on Cognitive Neuroscience XI, Mallorca, Spain (2011).
29. Voytek JB, Voytek B. Hypothesis generation and reconstruction of the connectome and cognome from the literature. Society for Neuroscience, Washington, DC, USA (2011).
30. Voytek JB, Voytek B, Warp E. User experience design for children's neuroscience education. Society for Neuroscience, New Orleans, LA, USA (2012).
31. Voytek B, Badre D, Kayser AS, Fegen D, Chang EF, Crone NE, Parvizi J, Knight RT, D'Esposito M. Phase/amplitude coupling supports network organization in human frontal cortex. Society for Neuroscience, New Orleans, LA, USA (2012).

32. Voytek B, Porat S, Chamberlain J, Balthazor J, Greenberg Z, Gill N, Gazzaley A. Examining the efficacy of the iPad and Xbox Kinect for cognitive science research. Entertainment Software and Cognitive Neurotherapeutics Society, Los Angeles, CA, USA (2013).
33. Greenberg Z, Gill N, Porat S, Samaha J, Kader T, Voytek B, Gazzaley A. Increased visual cortical noise decreases cued visual attention distribution. Cognitive Neuroscience Society, San Francisco, CA, USA (2013).
34. Voytek B & Gunduz A. Neuronal ensembles for BCI: Local field potentials and electrocorticography. Fifth International BCI Meeting, Asilomar, Pacific Grove, CA, USA (2013).
35. Voytek B, Case J, Tempesta ZR, Knight RT, Gazzaley A. Aging increases neural noise in humans. Society for Neuroscience, San Diego, CA, USA (2013).
36. Reuter K, Daigre J, Chatterjee A, Voytek B. Spreading Research And Engaging Disease Communities – One Automated Tweet at a Time. American Medical Informatics Association, Washington, DC, USA (2014).
37. Haller M, Varma P, Noto T, Knight RT, Shestyuk A, Voytek B. Automated “spectrally fingerprinting” of electrophysiological oscillations. Society for Neuroscience, Washington, DC, USA (2014).
38. Noto T & Voytek B. Spectral whitening influences oscillatory dynamics and behavior in humans. Cognitive Neuroscience Society, San Francisco, CA, USA (2015).
39. Cole SR, Peterson EJ, de Hemptinne C, Starr PA, Voytek B. Deep brain stimulation increases motor cortical 1/f noise and decouples high gamma amplitude from beta phase. Society for Neuroscience, Chicago, IL, USA (2015).
40. Gao R & Voytek B. Exploring the neural basis of the electrophysiological power spectrum. Society for Neuroscience, Chicago, IL, USA (2015).
41. Gouglet RJ, Donoghue T, Piper M, Althoff A, Urbach TP, Voytek B. Influencing visual target detection with oscillatory phase-specific stimulus presentation. Society for Neuroscience, Chicago, IL, USA (2015).
42. Noto T, Gao R, Peterson E, Voytek B. Neural network properties can be inferred from electrophysiological power spectral geometry. Society for Neuroscience, Chicago, IL, USA (2015).
43. Peterson E & Voytek B. Spike-field coupling does not imply spike-spike coupling. Society for Neuroscience, Chicago, IL, USA (2015).
44. Tran T, Hoffner N, Voytek B. Oscillatory visual cortical alpha disruptions in age-related working memory impairments. Society for Neuroscience, Chicago, IL, USA (2015).
45. van der Meij R, Bidet-Caulet A, Parvizi J, Crone N, Chang E, Knight RT, Voytek B. Auditory attention modulates frontal and temporal oscillatory dynamics in humans: Evidence from electrocorticography. Society for Neuroscience, Chicago, IL, USA (2015).
46. Donoghue T, Sebastian P, Voytek B. Automated Analysis of Resting State Cortical Oscillatory Characteristics using Magnetoencephalography (MEG). International Conference on Biomagnetism, Seoul, South Korea (2016).
47. Cole SR & Voytek B. Nonsinusoidal oscillatory shape can drive spurious cross-frequency coupling. Society for Neuroscience, San Diego, CA, USA (2016).

48. Donoghue T, Fox W, Kim A, Voytek B. The relation of alpha-phase to visual perception is dependent on attention and location of stimuli. Society for Neuroscience, San Diego, CA, USA (2016).
49. Gao R & Voytek B. Spiking correlates and temporal variability of oscillatory frequency modulation. Society for Neuroscience, San Diego, CA, USA (2016).
50. Gougelet R, Ouyang AC, Patel RD, Wang X, Voytek B. Evaluating high-resolution frequency spectral estimation approaches to real-time frequency modulation neurofeedback. Society for Neuroscience, San Diego, CA, USA (2016).
51. Izhikevich L, Peterson EJ, Voytek B. Neural oscillatory power is not Gaussian distributed across time. Society for Neuroscience, San Diego, CA, USA (2016).
52. Peterson EJ & Voytek B. Gain control across cortical layers can be mediated by balanced oscillatory coupling. Society for Neuroscience, San Diego, CA, USA (2016).
53. Rosen B, Peterson EJ, Campbell AM, Belger A, Voytek B. Spectral 1/f noise differences account for apparent oscillatory band-specific effects in Schizophrenia. Society for Neuroscience, San Diego, CA, USA (2016).
54. Sebastian P, Donoghue T, Noto T, Haxby S, Voytek B. Data mining to generate novel hypotheses for the genetic underpinnings and functional roles of cortical oscillations. Society for Neuroscience, San Diego, CA, USA (2016).
55. van der Meij R, Maris E, Voytek B. Extracting neural networks formed by consistent between-cell spike timing from unit recordings. Society for Neuroscience, San Diego, CA, USA (2016).
56. Samaha J, Sprague TC, Voytek B, Gazzaley A, Postle BR. Preparatory encoding of the location and scope of human spatial attention. Society for Neuroscience, San Diego, CA, USA (2016).
57. Donoghue T & Voytek B. Automated meta-analysis of event-related potentials and their correlates through text-mining. Cognitive Neuroscience Society, San Francisco, CA, USA (2017).
58. Tran T, Gazzaley A, Voytek B. Spatial attention reduces visual cortical 1/f neural noise. Cognitive Neuroscience Society, San Francisco, CA, USA (2017).
59. Gajawelli N, Voytek B, Wang DJJ, Zlokovic B, Toga AW, Law M, Morris J, Benzinger T, Pa J. Power law exponent analysis of the resting state BOLD signal as a potential measure of excitatory-inhibitory balance in Alzheimer's disease. International Society for Magnetic Resonance in Medicine, Honolulu, HI, USA (2017).
60. Holdgraf C, Bouchard KE, Flinker A, Gorgolewski KJ, Gunduz A, Hamilton LS, Knight RT, Perry M, Petridou N, Ramsey NF, Schaefer G, Swann NC, Voytek B, Winawer J, Hermes D. BIDS-iEEG: a data structure for intracranial EEG that facilitates open data and integration with other human imaging methods. Society for Neuroscience, Washington, DC, USA (2017).
61. van der Meij R, Voytek B. Extracting neural networks formed by consistent between-population spike timing from multiunit activity. Society for Neuroscience, Washington, DC, USA (2017).
62. Gao R, Negraes P, Trujillo C, Muotri A, Voytek B. Network oscillations spontaneously emerge in human iPSC-derived cortical organoids. Society for Neuroscience, Washington, DC, USA (2017).

63. Cole S & Voytek B. The waveform shape of hippocampal theta oscillations weakly informs local spiking statistics. Society for Neuroscience, Washington, DC, USA (2017).
64. Peterson E & Voytek B. The tradeoff between oscillatory communication and neural computation. Society for Neuroscience, Washington, DC, USA (2017).
65. Tran T, Itthipuripat S, Serences J, Voytek B. Selective attention reduces trial-by-trial variability in stimulus-evoked EEG activity. Society for Neuroscience, Washington, DC, USA (2017).
66. Liao L, Gao R, Voytek B. Differentiating noise from structure in electrophysiological power spectra via the spectral coefficient of variation. Society for Neuroscience, Washington, DC, USA (2017).
67. Donoghue T & Voytek B. Assessing approaches for estimating the electrophysiological 1/f background spectrum. Society for Neuroscience, Washington, DC, USA (2017).
68. Affan R, Tran T, van der Meij R, Voytek B. 1/f Neural Noise and Theta Oscillation in Frontotemporal Cortical Region during Memory Formation. Annual Biomedical Research Conference for Minority Students, Phoenix, AZ, USA (2017).
69. Donoghue T & Voytek B. Alpha Power and 1/f Slope Provide Independent Decoding of Spatial Attention. Cognitive Neuroscience Society, Boston, MA, USA (2018).
70. Cole S & Voytek B. Brain oscillations and the importance of waveform shape. International Conference on Biomagnetism, Philadelphia, PA, USA (2018).
71. Donoghue T, Sebastian P, Voytek B. Large-Scale Topographical Analysis of Oscillations and 1/f Background Reveals Patterns of Spatial Variation Within and Between Subjects. International Conference on Biomagnetism, Philadelphia, PA, USA (2018).
72. Donoghue T, Sebastian P, Noto T, Haxby S, Voytek B. Integrating human electrophysiology, gene expression, and functional data. INCF Neuroinformatics, Montréal, Canada (2018).
73. Gao R, Liao L, Voytek B. Spectral Power Variation Separates Oscillatory from Non-Oscillatory Stochastic Neural Dynamics. Conference on Cognitive Computational Neuroscience, Philadelphia, PA, USA (2018).
74. Cole S & Voytek B. Characterization of neural oscillations using a cycle-by-cycle approach. Society for Neuroscience, San Diego, CA, USA (2018).
75. Donoghue T, Haller M, Peterson E, Varma P, Sebastian P, Gao R, Noto TJ, Knight RT, Shestiyuk A, Voytek B. Parameterizing neural power spectra. Society for Neuroscience, San Diego, CA, USA (2018).
76. Jackson N, Cole SR, Voytek B, Swann NC. Characteristics of beta waveform shape in Parkinson's disease detected with scalp electroencephalography. Society for Neuroscience, San Diego, CA, USA (2018).
77. Mdanda L, Donoghue T, Voytek B. Parameterization of periodic and aperiodic human electrophysiology reveals greater between- than within-subject variability. Society for Neuroscience, San Diego, CA, USA (2018).
78. Yang Y, Cole SR, Gilja V, Voytek B. Neural oscillation symmetry as a novel feature for decoding algorithms in brain-computer interfaces. Society for Neuroscience, San Diego, CA, USA (2018).
79. Gougelet RJ, Miyakoshi M, Voytek B, Makieš S. Oscillatory mechanisms of planning vs. memory. Society for Neuroscience, San Diego, CA, USA (2018).

80. Trujillo CA, Gao R, Negraes P, Chaim IA, Domissy A, Vandenberghe M, Devor A, Yeo GW, Voytek B, Muotri AR. Spontaneous functional network activity in organoids resembles programmed early human brain development. Society for Neuroscience, San Diego, CA, USA (2018).
81. Cain SS, Voytek B, Gentler TQ. Sound texture evoked potentials encode acoustic complexity over time in avian auditory cortex. Society for Neuroscience, San Diego, CA, USA (2018).
82. Tran T & Voytek B. Predicting memory formation using theta oscillations and temporal-frontal oscillatory coupling. Society for Neuroscience, San Diego, CA, USA (2018).
83. Loughnan RJ, Donoghue T, Voytek B, Mukamel EA. Deconvolution of bulk RNA sequencing data to estimate neuron type abundance across human cortical regions. Society for Neuroscience, San Diego, CA, USA (2018).
84. Peterson E & Voytek B. Homeostasis and oscillatory modulation. Society for Neuroscience, San Diego, CA, USA (2018).
85. Robertson MM, Furlong S, Voytek B, Boettiger CA, Sheridan MA. Elevated slope of the EEG power spectrum: a novel biomarker for ADHD in childhood. Cognitive Neuroscience Society, San Francisco, CA, USA (2019).
86. Pasumarthi S, Cole S, Washington A, Voytek B. Evaluation of Neural Oscillation Burst Detection Algorithms. Cognitive Neuroscience Society, San Francisco, CA, USA (2019).
87. Donoghue & Voytek B. WORKSHOP: New methods for analyzing periodic oscillations and aperiodic 1/f in electrophysiology. Cognitive Neuroscience Society, San Francisco, CA, USA (2019).
88. Dominguez J, Donoghue T, Voytek B. Electrophysiological Frequency Band-Ratio Measures Conflate Changes in Periodic and Aperiodic Features. Cognitive Neuroscience Society, San Francisco, CA, USA (2019).
89. Enriquez-Geppert S, Berend S, Dickhut C, Bösterling M, Hieke S, Greve M, Voytek B, Aleman A. A 1/f  $\chi$  neural noise perspective on age-related changes in cognitive and emotion control. Organization for Human Brain Mapping, Rome, Italy (2019).
90. Waschke L, Donoghue T, Smith S, Voytek B, Obleser J. Aperiodic EEG activity tracks 1/f stimulus characteristics and the allocation of cognitive resources. Conference on Cognitive Computational Neuroscience, Berlin, Germany (2019).
91. Donoghue T, Gao R, Waschke L, Voytek B. A Simulation-Based Comparison of Methods for Analyzing Aperiodic Neural Activity. Conference on Cognitive Computational Neuroscience, Berlin, Germany (2019).
92. Gao R, Christiano D, Donoghue T, Voytek B. The Structure of Cognition Across Computational Cognitive Neuroscience. Conference on Cognitive Computational Neuroscience, Berlin, Germany (2019).
93. Gao R & Voytek B. Hierarchy of cortical population characteristic timescales inferred from field potentials. Society for Neuroscience, Chicago, IL, USA (2019).
94. Tran T & Voytek B. Prefrontal cortical aperiodic activity tracks the number of items held in short-term memory. Society for Neuroscience, Chicago, IL, USA (2019).
95. Smith S & Voytek B. Oscillatory mechanisms of electroconvulsive therapy (ECT) for Major Depressive disorder (MDD). Society for Neuroscience, Chicago, IL, USA (2019).

96. van Engan Q & Voytek B. Dissociating contributions of periodic and aperiodic neural activity in human visual working memory. Society for Neuroscience, Chicago, IL, USA (2019).
97. Waschke L, Donoghue T, Smith S, Voytek B, Obleser J. Tracking of 1/f stimulus characteristics in the human electroencephalogram. Society for Neuroscience, Chicago, IL, USA (2019).
98. Zhang F, Donoghue T, Voytek B. Comparing the effects of pre-stimulus periodic and aperiodic activity on post-stimulus event-related potentials. Society for Neuroscience, Chicago, IL, USA (2019).
99. Hohil A, Gao R, Voytek B. Assessing how periodic oscillation properties influence estimates of aperiodic neural activity. Society for Neuroscience, Chicago, IL, USA (2019).
100. Ghatak S, Dolatabadi N, Gao R, Trudler D, Wu Y, Zhang X, Sultan A, Talantova MV, Amba Sudhan R, Voytek B, Lipton SA. Hyperexcitability in Alzheimer's disease hiPSC derived neurons and cerebral organoids is a result of both increased excitation and decreased inhibition. Society for Neuroscience, Chicago, IL, USA (2019).
101. Farnan T, Donoghue T, Voytek B. Evaluating spectral estimation methods for time-resolved measurement of aperiodic activity. Society for Neuroscience, Chicago, IL, USA (2019).

## Rejections and failures

### Academic and professional

- University of Southern California: academic probation, loss of scholarships, ejected from the university due to low GPA (successfully appealed re-admission), 2000
- Applied to neuroscience PhD programs at UC Berkeley, UC Irvine, UCLA, UC San Diego, and UC San Francisco. Rejected with no interviews, except Berkeley, 2004
- Applied to two faculty jobs in 2010 and three in 2012; received one offer

### Scientific peer-review

- Voytek et al. (2010), J Cogn Neurosci 2010: rejected from 3 journals
- Voytek & Knight (2010), Proc Natl Acad Sci USA: rejected from 2 journals
- Voytek et al. (2010), Neuron: rejected from 3 journals and twice from Neuron
- Voytek et al. (2012), PLoS One: rejected from 7 journals
- Voytek & Voytek (2012), J Neurosci Methods: rejected from 13 journals
- Voytek et al. (2013), NeuroImage: rejected from 2 journals and once from NeuroImage
- Voytek et al. (2015), Nature Neuroscience: rejected from 2 journals
- Voytek et al. (2015), J Neurosci: rejected from 3 journals and once from J Neurosci
- Tran et al. (2016), NeuroImage: rejected from 3 journals
- Voytek et al. (2017), J Cogn Neurosci: rejected from 3 journals
- Cole et al. (2017), J Neurosci: rejected from 2 journals and once from J Neurosci
- Gao et al. (2017), NeuroImage: rejected from 6 journals
- Cole & Voytek (2019), J Neurophysiol: rejected from 3 journals
- Trujillo et al. (2019), Cell Stem Cell: rejected from 3 journals

- Tran et al. (2020), J Cogn Neurosci: rejected from 1 journal

### **Awards & grants**

- University of California Berkeley: Teaching Effectiveness Award, not awarded 2005
- National Science Foundation: Graduate Research Fellowship, not awarded 2004, 2005
- University of California President's Postdoctoral Fellowship Program: not awarded 2010
- Glushko Dissertation Prize: nominated 2010; not awarded
- Branco Weiss Fellowship: not awarded 2011
- AAAS Early Career Award for Public Engagement with Science: nominated 2011, 2013; not awarded
- American Federation for Aging Research Grants for Junior Faculty: not awarded 2014, 2015
- Simons Foundation Global Brain: not awarded 2014
- Gordon & Betty Moore Foundation Data-Driven Discovery Investigator: not awarded 2014
- UC Multicampus Research Programs and Initiatives: not awarded 2014
- Searle Scholars Program application denied, 2014; advanced but denied, 2015
- Rita Allen Scholars Award: not awarded 2016
- McKnight Memory and Cognitive Disorders Award: not awarded 2015, 2016, 2017
- Klingenstein-Simons Fellowship Award in the Neurosciences: not awarded 2015, 2016, 2017
- Pew Biomedical Scholars Award: not awarded 2016
- Blavatnik National Awards for Young Scientists: not awarded 2016, 2018
- Brain & Behavior Research Foundation (NARSAD) Award: not awarded 2016, 2017
- NSF CAREER Award: not awarded 2016, 2017
- Office of Naval Research Multidisciplinary University Research Initiative (MURI), Neural Basis of Symbolic Processing: not awarded 2016
- NIH Director's New Innovator Award Program (DP2): not awarded 2016
- Packard Fellowships for Science and Engineering: not awarded 2016
- UC San Diego Hellman Fellowship Program: not awarded 2016, 2017
- UC San Diego Faculty Career Development Program: not awarded 2016, 2017
- Whitehall Foundation: not awarded 2016 (won in 2017)
- Dana Foundation David Mahoney Neuroimaging Program: not awarded 2016
- INCF Seed Funding: not awarded 2016
- McKnight Scholar Award: not awarded 2017
- NIMH R01: not awarded 2016; revised and denied 2017
- NIMH R24: not awarded 2018
- NIMH R01: not awarded 2018
- Keck Foundation Science and Engineering Research Program: not awarded 2018
- Chan Zuckerberg Initiative Ben Barres Early Career Acceleration Award: not awarded 2018
- NSF Harnessing the Data Revolution: Data Science Corps grant: not awarded 2019
- NYSCF Innovator Awards in Neuroscience program: not awarded 2019



- Chan Zuckerberg Initiative Essential Open Source Software for Science: not awarded 2019
- Mahoney Institute for Neurosciences at the University of Pennsylvania RisingStar Award in Brain Science Technology: not awarded 2020
- Chan Zuckerberg Inflammation grant: not awarded 2020
- James S. McDonnell Foundation Understanding Human Cognition grant: not awarded 2020

## Very Important Metrics

Erdős–Bacon number = 7 ([link](#))

### Erdős number = 4

1. Ronald Graham (Erdős 1) and Paul Erdős. Old and new problems and results in combinatorial number theory (1980).
2. Fan R. K. Chung, Ronald Graham, Shing Tung Yau (Erdős 2). On sampling with Markov chains. Random Structures & Algorithms, 9, 55-77 (1996).
3. Wang YL, Gu X, Hayashi KM, Chan TF, Thompson PM (Erdős 3), Yau ST. Brain surface parameterization using Riemann surface structure. International Conference on Medical Image Computing and Computer-Assisted Intervention (2005).
4. London ED, Berman SM, **Voytek B** (Erdős 4), Simon SL, Mandelkern MA, Monterosso J, Thompson PM, Brody AL, Geaga JA, Hong MS, Hayashi KM, Rawson RA, Ling W. Cerebral metabolic dysfunction and impaired vigilance in recently abstinent methamphetamine abusers. Biol Psychiatry 58, 770-778 (2005).

### Bacon number = 3

1. Tom Savini (Bacon 1) with Kevin Bacon, Friday the 13th (1980).
2. Max Brooks (Bacon 2) with Tom Savini, Doc of the Dead (2014).
3. Bradley Voytek (Bacon 3) with Max Brooks, Zombies: The Truth (2010).