

FELLOWSHIP APPLICANT BIOGRAPHICAL SKETCH

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NAME OF FELLOWSHIP APPLICANT Daniel S. Barron	POSITION TITLE Fellow, Pain Medicine, University of Washington Department of Anesthesiology & Pain Medicine
eRA COMMONS USER NAME (credential, e.g., agency login) BarronD	

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
UT Health Science Center at San Antonio, TX	PhD	05/14	Human Brain Imaging
Yale University, New Haven, CT	MD	05/16	Medicine
Yale University, New Haven, CT		6/20	Adult Psychiatry Residency

Please refer to the application instructions in order to complete sections A, B, C, and D of the Biographical Sketch.

A. Personal Statement

My training in clinical neuroscience began as an undergraduate student, when I declared a neuroscience major during my second semester and used visual evoked response EEG to study human cocaine addiction as part of my Honors Thesis. Because I enjoyed clinical research's pragmatic approach, I pursued an MD/PhD in San Antonio where I studied human brain imaging under Peter Fox.

I thoroughly enjoyed working with Fox. With his mentorship, I secured NIH F31 funding through the NINDS for my dissertation, which studied brain damage in temporal lobe epilepsy. We developed a meta-analytic model of temporal lobe epilepsy that led us to study thalamo-hippocampal connectivity in subsequent independent patient samples using structural, diffusion-weighted, and resting-state MRI. We succeeded in our goal of developing a biomarker to lateralize seizure onset and, since this time, I have been interested in biology-driven markers of brain disease. As part of my graduate school requirements, I took courses in radiation physics and enjoyed learning about practical applications of clinical imaging modalities, like fluoroscopy. I enjoyed the opportunity to develop national and international collaborations during this time and this cemented my interest in clinical neuroscience.

I transferred to Yale Medical School following my PhD defense and, as a 4th year medical student, organized a 6-month post-doc at Oxford University with Catherine Harmer, Michael Browning and Eugene Duff. Here I learned to process task-based fMRI studies of antidepressant action. By looking across 13 datasets, we trained a machine learning classifier to identify a neural signature of emotional valence and of antidepressant action. I also began to think deeply about pharmaceutical drug study design and the importance of measurable, biology-driven endpoints in clinical research. I began to observe that many of the datapoints I used to probe brain function (by correlating a given diagnosis or functional attribute with brain activity as measured with fMRI) were not empirically grounded, objective measures. This observation led me to investigate digital devices like the smartphone and wrist worn accelerometer as possible instruments that could provide useful data.

During medical school, I became a regular contributor to Scientific American. I have written on a wide range of topics including neuroscience, health policy, student debt, and scientific ethics. My first book, "Reading Our Minds: The Rise of Big Data Psychiatry," was funded by the Robert Wood Johnson Foundation and will be published in spring 2021 by Columbia Global Reports, an imprint of Columbia University.

As a resident in Yale's Neuroscience Research Training Program (NRTP) and with the help of my co-mentors John Krystal and Todd Constable, I served as the Principal Investigator for a joint study agreement with IBM to combine digital phenotypes (kinematic face expression, voice acoustics, and natural language processing) and functional MRI to define quantitative measures of behavior and brain function. As a third-year resident, I noted that many of my patients suffer from chronic pain and I quickly realized not only that I know little about pain treatment, but also

that treating my patient's pain is an essential part of their mental health treatment. Encouraged by my mentors, I organized a two-month rotation through Yale's Interventional Pain Clinic and discovered that I have a high aptitude for and enjoyment of procedures. I'm currently a fellow in Pain Medicine at the University of Washington starting July 2020. Following this fellowship, I expect to run an interventional pain clinic that seeks to define markers (digital and biological) of pain phenotypes and to improve and measure patient outcomes.

B. Positions and Honors

Positions and Employment

2009-2014 MD/PhD Student, University of TX Health Science Center at San Antonio
2009-2014 Editor, *Connective Tissue*
2010-2011 Teaching Assistant, Histology
2014-2016 Medical Student, Yale University
2015-2016 Visiting Researcher, Oxford University
2016-2017 Medical Internship, Yale University
2017-2020 Psychiatry Residency, Neuroscience Research Training Program, Yale University
2019-2020 Chief Resident, Clinical Neuroscience Research Unit, Connecticut Mental Health Center
2019-2020 Chief Resident, Neuroscience Research Training Program, Yale University
2018-2020 Officer on Duty, Silver Hill Hospital, New Canaan, CT

Honors:

2010 Dr. David Henzi Award for Academic Medicine
2010 Best Poem, *Connective Tissue*
2011 Excellence in Histology Teaching
2012 Holt Bioethics Essay award, 3rd place
2012 Travel Award, American Neurology Association Meeting
2014 Holt Bioethics Essay award, 2nd place
2015 Rush Lerner Award for Creative Writing
2018 Thomas P. Detre Fellowship to support research by resident at Yale
2019 Chair's Choice Award, Society of Biological Psychiatry

Other Experience and Professional Membership:

Affiliations:

Society for Biological Psychiatry
Organization for Human Brain Mapping

Review Editor:

Frontiers in Pain Research, Pain Research Methods (beginning 9/2020)

Ad-hoc Journal Reviewer:

Brain Structure & Function: 2019, 2020
Epilepsia: 2015, 2015, 2015, 2018
European Journal of Neurology: 2015
Human Brain Mapping: 2016, 2019, 2019, 2019, 2019
Journal of Autism & Developmental Disorders: 2019
Neuroimage: Clinical: 2016, 2017
Neuroscience & Biobehavioral Reviews: 2018, 2019
Plos ONE: 2016
Medical Principles & Practice: 2015

Professional Certifications:

2018-2020: Medical License, Connecticut
2020-Present: Medical License, Washington
2018-present: DEA Registration with schedules 2, 2N, 3, 3N, 4, 5 (+Buprenorphine Certification)

C. Contributions to Science

Full list of peer-reviewed publications (>430 citations, h-index=9) can be found here:

<https://scholar.google.com/citations?user=JfNOWcsAAAAJ&hl=en>.

1. **Predictive Modeling.** Much of my recent work has applied and developed methods to predict phenotypic traits from functional brain imaging data. This work began during my 4th year of medical school, during a six-month post-doc at Oxford University with Eugene Duff, Catherine Harmer, and Michael Browning. Here, I used a support vector machine learning algorithm to predict antidepressant response in task-based fMRI. More recently, I have worked with Todd Constable to apply connectome-based predictive modeling to predict phenotypic traits. I am currently collecting computational phenotypes in multiple patient populations with the hope of predicting these phenotypes from connectome data.

Barron DS, Salehi M, Browning M, Harmer CJ, Constable RT, Duff E (2018). Exploring the prediction of emotional valence and pharmacologic effect across fMRI studies of antidepressants. *NeuroImage: Clinical* 20, 407-414.

Scheinost D, Noble S, Horien C, Greene AS, Lake E, Salehi M, Gao S, Shen X, O'Connor D, Barron DS, Yip SW, Rosenberg MD, Constable RT (2019). Ten Simple Rules for Predictive Modeling of Individual Differences in Neuroimaging. *Neuroimage*, 193, 35-45.

Salehi M, Karbasi A, Barron DS, Scheinost D, Constable RT (2020). State-specific individualized functional networks form a predictive signature of brain state. *Neuroimage*, 206: 116233.

Makary MM, Polosecki P, Cecchi GA, DeAraujo IE, Barron DS, Constable TR, Whang PG, Thomas DA, Mowafi H, Small DM, Geha P (2020). Loss of nucleus accumbens low-frequency fluctuations is a signature of chronic pain. *Proceedings of the National Academy of Sciences*, 117: 18, 10015-10023

Barron DS, Gao S, Dadashkarimi J, Green AS, Span MN, Noble S, Lake E, Krystal J, Constable RT, Scheinost D. Task-Based Functional Connectomes Predict Phenotypic Traits Across Psychiatric Diagnosis. Posted on bioRxiv: <https://www.biorxiv.org/content/biorxiv/early/2019/05/16/638825.full.pdf> In review, *Cerebral Cortex* (10/2020)

Barron D, Heisig S, Norel R, Agurto C, Quagan B, Powers A, *et al.* (2020): Preliminary Phenotypic Feature Capture During Clinical Interaction. *Biol Psychiat* 87: S212–S213. (Formal manuscript in preparation)

2. **Large-scale meta-analytic modeling of brain structure and function.** As a graduate student working with Peter Fox, I applied and helped develop coordinate-based meta-analytic methods, primarily in reference to the BrainMap database. By pairing the results of neuroimaging studies with their relevant meta-data, BrainMap facilitates coordinate-based meta-analysis (CBMA) of the neuroimaging literature *en masse* or at the level of experimental paradigm, clinical disease, or anatomic location. Initially dedicated to the functional, task-activation literature, I helped expand the BrainMap database to include voxel-based morphometry (VBM) studies. I have use BrainMap data to model changes in brain structure and/or function in multiple diseases including temporal lobe epilepsy (more below in Biomarker Development), stuttering, Parkinsonism, and eating disorders. I have further used BrainMap to model the functional divisions of brain regions such as the thalamic pulvinar and hippocampus.

Barron DS, Fox PM, Laird AR, Robinson JL, Fox PT. Thalamic Medial Dorsal Nucleus Atrophy in Medial Temporal Lobe Epilepsy: a VBM meta-analysis. *NeuroImage: (2013) Clinical*; 2: 25–32.

Barron DS, Fox PT. (2014) BrainMap Database as a Resource for Computational Modeling. *Brain Mapping: An Encyclopedic Reference*. Elsevier Press.

Budde KS, Barron DS, Fox PT. (2014) Stuttering, Induced Fluency, and Natural Fluency: A Hierarchical Series of Activation Likelihood Estimation Meta-Analyses. *Brain & Language*; 139: 99-107.

Barron DS, Clos M, Eickhoff SE, Fox PT. (2015) Human Pulvinar Functional Organization and Connectivity. *Human Brain Mapping*. Published Online 28 Mar 2015. DOI: 10.1002/hbm.22781

Robinson, J. L., Barron, D. S., Kirby, L. A. J., Bottenhorn, K. L., Hill, A. C., Murphy, J. E., et al. (2015). Neurofunctional topography of the human hippocampus. *Human Brain Mapping*, 36(12), 5018–5037. <http://doi.org/10.1002/hbm.22987>

Yu F, Barron DS, Bundhit T, Fox PT. (2015) Patterns of Grey Matter Atrophy in Atypical Parkinsonism Syndromes: A Meta-Analysis. *Brain & Behavior*. Published Online 1.March.2015, DOI: 10.1002/brb3.329

Yu R, Barron DS, Tantiwongkosi B, Fox M, Fox PT (2018). Characterisation of meta-analytical functional connectivity in progressive supranuclear palsy. *Clinical radiology* 73 (4), 415. e1-415. e7

Vanasse T, Fox M, Barron DS, Robertson M, Eickhoff S, Lancaster J, Fox P. (2018) BrainMap VBM: An Environment for Structural Meta-analysis. *Human Brain Mapping* 39 (8), 3308-3325. DOI: 10.102/hbm.24078.

Liu A, Friedman D, Barron DS, Wang X, Thesen T, Dugan P (2020). *Epilepsy & Behavior* 104, 106644.

Bangshan L, Liu J, Ju Y, Wang M, Liu , Zhang Y, Li L, Potenza MN, Barron DS. Altered brain function in anorexia nervosa and bulimia nervosa: A hierarchical series of task-based fMRI meta-analyses. *In revision from AJP, Biological Psychiatry; In review Neuroscience & Biobehavioral Reviews. Posted on bioRxiv: <https://www.biorxiv.org/content/biorxiv/early/2019/02/14/550301.full.pdf>*

- 3. Biomarker Development.** My graduate school work developed a brain-based biomarker to lateralize seizure onset zone in temporal lobe epilepsy patients. We first developed a refined, meta-analytic model of brain damage in temporal lobe epilepsy patients that focused on the thalamus and hippocampus (paper above). We then applied this model in independent structural (T1 and diffusion weighted MRI) and resting-state fMRI datasets. My efforts in predictive modeling (above) are born of my desire to develop quantitative biomarkers for brain disease.

Barron DS, Lancaster JL, Tandon N, Fox PT. (2014) Thalamic Structural Connectivity in Medial Temporal Lobe Epilepsy. *Epilepsia*; 55:6, e50-e55. doi: 10.1111/epi.12637.

Barron DS, Fox PT, Pardoe H, Lancaster J, Price LR, Blackmon K, Berry K, Cavazos JE, Devinsky O, Kuzniecky R, Thesen T. (2014) Thalamic Functional Connectivity Predicts Seizure Laterality in Individual TLE Patients: application of a biomarker development strategy. *Neuroimage: Clinical*. Published Online Aug 7, 2014: 10.1016/j.nicl.2014.08.002

Barron DS, Krystal J. Why Does Psychiatry Lack Biomarkers? *In preparation*.

4. Invited Book Chapters

Barron, DS & Castellanos FX. (2016). Attention Networks. *In Neuroscience in the 21st Century* (pp. 1–15). New York, NY: Springer New York. http://doi.org/10.1007/978-1-4614-6434-1_177-1

Barron DS, Higgins S, Westphal A (2017). *The impact of neuroscience and other technological developments on forensic psychiatry*. In: Griffith E, Norko M, Buchanan A, Baranoski M and Zonana H, editors. Bearing Witness to Change in Forensic Psychiatry Practice. New York: CRC Taylor & Francis Group.

Barron DS, Ostroff R (2018). *Cognitive Therapy versus Medication in the Treatment of Moderate to Severe Depression*. In: Bhalla IP, Tampi RR, Srihari VR, editors. 50 Studies Every Psychiatrist Should Know. Oxford University Press. DOI: 10.1093/med/9780190625085.001.0001

Barron DS, Capurso N (2018). *Clozapine for Suicidality in Schizophrenia: The International Suicide Prevention Trial (InterSePT)*. In: Bhalla IP, Tampi RR, Srihari VR, editors. 50 Studies Every Psychiatrist Should Know. Oxford University Press. DOI: 10.1093/med/9780190625085.001.0001

Barron DS, Budde KS, Gold JA, Yonkers K, Cook JM (2020). Engaging the Popular Media. In: *A Psychiatrist's Guide to Advocacy*, 191.

D. Contributions to Pubic Science Engagement

Barron DS (2017). Future Humans: Inside the Science of Our Continuing Evolution. *Yale J Biol Med*, 90(3): 517.

National Neuroscience Curriculum Initiative Website: <http://www.nncionline.org>:

Magnetic Resonance Imaging for Psychiatrists, 2015

Default Mode Network: The Basics for Psychiatrists, 2015

Scientific American Page: <https://www.scientificamerican.com/author/daniel-barron/>

Getting Past the “Shotgun” Approach to Treating Mental Illness, March 10, 2016

Brains on Trial, March 23, 2016

How the Brain Processes Images, May 10, 2016

Psychiatry When You Don’t Speak the Language, June 23, 2016

How a Curious Condition Solved a Neuroscientific Mystery, August 22, 2016

Do You Suffer from Trump Syndrome? October 17, 2016

How Studying Neuroscience Transformed My Brain, November 16, 2016

Should We Let Doctors-in-Training Be More Sleep Deprived? December 19, 2016

The Rise of Evidence-Based Psychiatry, February 28, 2017

Case Study: When Chronic Pain Leads to a Dangerous Addiction, March 1, 2017

When Psychiatry Needs Neuroscience, April 25, 2017

The Role of Neuroscience in Psychiatry Redux, April 28, 2017

What Do “Emotion” and “Mood” Actually Mean? June 21, 2017

The U.S. Supreme Court Stymes Science, July 6, 2017

New Hope for Children Who Nearly Drown, August 7, 2017

Scientists, Break Out of That Ivory Tower, September 28, 2017

The Neuroscience of Paid Parental Leave, October 30, 2017

The Economics of Paid Parental Leave, November 29, 2017

The Chronification of Pain, December 29, 2017

Why Don’t Babies Smile from Birth? February 6, 2018

What Makes Us Vibe? February 20, 2018

Can We Measure Delusions? March 19, 2018

Mindfulness Under the Sea, May 9, 2018

Who Are You Calling Normal?, May 15, 2018

How Freely Should Scientists Share Their Data?, August 13, 2018

Is Chronic Anxiety a Learning Disorder?, October 11, 2018

Should Mental Disorders Have Names?, Feb 18, 2019

Psychiatry’s Inevitable Hubris, May 8, 2019

Why Doctors Are Drowning In Student Debt, July 15, 2019

Has Telemedicine’s Day Finally Come?, March 21, 2020

Health Care Workers Don’t Want to Be Heroes, June 21, 2020

Invited Talks and Interviews:

Neuroscience Seminar, McLean Hospital:

“Can machine learning decode emotional valence, clinical state, and antidepressant signatures in fMRI data?”, Boston, MA, 2/14/2017

Keynote address:

“*Democratizing Data – Whose Decision Is It?*”, National Federation of Advanced Information Services 61st annual conference in Alexandria, VA, 2/15/2018

Podcast Interviews:

“Do Good Scientists Share Data?”, The ORION Open Science Podcast, 2/7/2019.

<https://orionopenscience.podbean.com/>

Video Interview:

“Where Do Your Med School Tuition Dollars Go?”, MedPageToday, 7/23/2019.

<https://www.medpagetoday.com/hospitalbasedmedicine/graduatemedicaleducation/81172>

“Where MedEd Tuition Goes? This Resident Has a Surprising Answer [Episode 331], Accepted, 9/24/2019.
<https://blog.accepted.com/one-doctors-path-to-becoming-a-neuroscientist-episode-331/>

E. Research Support

Current Research Support

2T32MH019961-21A1 Malison R (PI) Role: Trainee 6/1/2018-6/30/2020
NIH/NIHDS

This supported my position within Yale University’s Neuroscience Research Training Program.

Completed Research Support

1 F31 NS083160 Barron (PI) Role: PI 4/01/13 - 5/31/15
NIH/NINDS

“Quantification of Thalamic Atrophy and Connectivity in Medial Temporal Lobe Epilepsy”

Medial temporal lobe epilepsy is the most common type of epilepsy referred to surgical centers and the most common localization-related epilepsy in adults. Undetected brain damage outside the hippocampus is predictive of poor surgical outcome, yet no consensus exists on where extra-hippocampal damage is most commonly found. This proposal to quantify extra-hippocampal damage using three neuroimage analysis methods promises to refine pre-surgical evaluation, guide future therapeutic approaches, and improve treatment success.

0000 Barron (PI) Role: PI 09/2015-02/2016

Office of Student Research, Yale University

“The Neural Signatures of Antidepressants”

Notwithstanding drug-specific modes of action, we hypothesized that antidepressant efficacy is associated with consistent patterns of brain activity and that machine-learning algorithms can be trained to distinguish an effective antidepressant from placebo based on brain activity patterns. This funded my 6-month post-doc at Oxford University.

0000 Barron (PI) Role: PI 12/2010-01/2011

Institute for Integration of Medicine and Science, UTHSCSA

“Clinical Epilepsy Traineeship”

This grant funded a 3-week traineeship to Università di Bologna in Italy. Here, I rotated through neurology and neurosurgery clinics as a medical student.