Arielle S. Keller, PhD

Post-Doctoral Fellow · Lifespan Informatics & Neuroimaging Center

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Education & Research Experience

University of Pennsylvania — *Philadelphia, PA*

T32 Neuroengineering and Medicine Post-Doctoral Fellow — *2021 - Present*

- Deptartment of Psychiatry
- Lifespan Informatics & Neuroimaging Center
- Advisor: Dr. Theodore Satterthwaite

Stanford University — *Stanford, CA*

PhD Neurosciences — *2016 - 2021*

- Department of Psychiatry and Behavioral Sciences
- Advisor: Dr. Leanne Williams
- Dissertation: "Attention impairment in depression and anxiety"

Brandeis University — *Waltham, MA*

MS Neuroscience — *2012 - 2016*

- Department of Psychology
- Advisor: Dr. Robert Sekuler
- Master's Thesis: "Characterizing the roles of alpha and theta oscillations in multisensory attention"

Brandeis University — *Waltham, MA*

BS Neuroscience, Psychology — *2012 - 2016*

- Summa Cum Laude, GPA: 3.95
- Minor: English
- Neuroscience Thesis with Highest Honors

Awards, Fellowships, & Grants

2022 **NIH Loan Repayment Program Awardee**, National Institute of Mental Health
2022 **Flux Congress Travel Award**, Flux Society
2021-2022 **NIH T32 Neuroengineering and Medicine Post-Doctoral Fellowship**, NINDS
2021 **Stanford Community Impact Award**, Stanford Alumni Association
2020 **Pre-Doctoral Travel Award**, Society of Biological Psychiatry
2018-2019 **Center for Neurological Imaging Innovation Grant**, Stanford University
2017-2021 **National Defense Science and Engineering Graduate Fellowship**, Department of Defense
2017-2021 **Mind, Brain, Computation and Technology Fellowship**, Stanford University
2017 **Honorable Mention**, NSF Graduate Research Fellowship
2016 **Reis and Sowul Family Prize in Neuroscience**, Brandeis University
2016 **Ricardo Morant Award in Psychology**, Brandeis University
2016 **Phi Beta Kappa**, Brandeis University
2016 **Honorable Mention**, NSF Graduate Research Fellowship
2015 **Goldwater Scholarship for Excellence in Research**, Brandeis University
2015 **Psi Chi: International Honor Society in Psychology**, Brandeis University
2015 **Sustaining the Mind Scholarship**, Brandeis University
2014-2016 **NIH Computational Neuroscience Traineeship**, Brandeis University
2014 **Conference Travel Award**, Brandeis University Office of the Provost

Publications

Keller, A. S., Sydnor, V. J., Pines, A., Fair, D. A, Bassett, D. S. & Satterthwaite, T. D. (2022) Hierarchical functional system development supports executive function. *Under Review*.

Keller, A. S.*, Jagadeesh, A.*, Bugatus, L., Williams, L. M. & Grill-Spector, K. (2022) Attention enhances category representations across the brain with strengthened residual correlations to ventral temporal cortex. *NeuroImage*.

Pines, A., **Keller, A. S.**, Larsen, B., Bertolero, M., Ashourvan, A., Bassett, D. S., Cieslak, M., Covitz, S., Fan, Y., Feczko, E., Houghton, A., Rueter, A. R., Tapera, T., Vogel, J., Weinstein, S. M., Shinohara, R. T., Fair, D. & Satterthwaite, T. D. (2022) Development of top-down cortical propagations in youth. *bioRxiv*.

Keller, A. S., Mackey, A. P., Pines, A., Fair, D., Feczko, E., Hoffman, M. S., Salum, G. A., Barzilay, R. & Satterthwaite, T. D. (2022) Caregiver monitoring, but not caregiver warmth, is associated with general cognition in two large sub-samples of youth from the ABCD study. *PsyArXiv*.

Keller, A. S., Ling, R. & Williams, L. M. (2021) Spatial attention impairments are characterized by specific electro-encephalographic correlates and partially mediate the association between early life stress and anxiety. *Cognitive, Affective and Behavioral Neuroscience*.

Holt-Gosselin, B., **Keller, A. S.**, Chesnut, M., Ling, R., Grisanzio, K. & Williams, L. M. (2021). Greater baseline connectivity of the salience and negative affect circuits are associated with natural improvements in anxiety over time in untreated participants. *Journal of Affective Disorders*.

Goldstein-Piekarski A. N., Ball T. M., Samara Z., Staveland B. R., **Keller A. S.**, Fleming S. L., Grisanzio K. A., Holt-Gosselin B., Stetz P., Ma J. & Williams L. M., (2021). Mapping neural circuit biotypes to symptoms and behavioral dimensions of depression and anxiety. *Biological Psychiatry*.

Keller, A. S., Davidesco, I. & Tanner, K. D. (2020). Attention Matters: How orchestrating attention relates to classroom learning. *Cell Biology Education - Life Sciences Ed.* 19(3):fe5.

Chilver, M. R., **Keller, A. S.**, Park, H., Jamshidi, J., Montalto, A., Schofield, P. R., Clark, C. R., Harmon-Jones, E., Williams, L. M.* & Gatt, J. M.* (2020). Electroencephalography profiles as a biomarker of wellbeing: A twin study. *Journal of Psychiatric Research*, 126, 114-121.

Rajpurkar, P., Dass D., Yang J., Vale, V., **Keller, A. S.**, Irvin, J., Taylor, Z., Basu, S., Ng, A. & Williams, L. M. (2020). Machine Learning Prediction of Treatment Response to Antidepressant Medication Using Pre-Treatment EEG: Development and Validation of the ElecTreeScore Algorithm, *JAMA Network Open*, 3(6):e206653.

Keller, A. S., Ball, T. M. & Williams, L. M. (2019). Deep phenotyping of attention impairments and the "Inattention Biotype" in Major Depressive Disorder. *Psychological Medicine*. 1-10.

Keller, A. S., Leikauf, J. E., Holt-Gosselin, B., Staveland, B. R. & Williams, L. M. (2019). Paying Attention To Attention in Depression. *Translational Psychiatry*. 9, 279. doi:10.1038/s41398-019-0616-1

Keller, A. S., Qiu, H.*, Li, J.* & Williams, L. M. (2019). Modeling attention impairments in Major Depression. *Proceedings of the Computational Cognitive Neuroscience Conference*. https://doi.org/10.32470/CCN.2019.1325-0

Keller, A. S. & Christopher, L. (2017). Distinct Phases of Tau, Amyloid, and Functional Connectivity in Healthy Older Adults. *The Journal of Neuroscience*. 37(37):8857-8859.

Keller, A. S., Payne, L. & Sekuler, R. (2017) Characterizing the roles of alpha and theta oscillations in multisensory attention. *Neuropsychologia*. 99:48-63.

Keller, A. S. & Sekuler, R. (2015). Memory and learning with rapid audiovisual sequences. *Journal of Vision*. 15(15):7. doi: 10.1167/15.15.7.

Invited Talks

Jul 2022. *Attention and Mental Health: A Developmental Cognitive Neuroscience Perspective*. Science Digest Seminar, Okinawa Institute of Science and Technology, Okinawa, Japan.

Jun 2022. *Machine Learning Facilitates Generalizable Associations with Cognitive and Clinical Measures in Large-scale Developmental Neuroimaging Datasets*. Symposium: Machine Learning in Neuroimaging, Organization for Human Brain Mapping, Glasgow, Scotland.

Apr 2022. *Parsing the Effects of Threat and Deprivation Adverse Childhood Experiences (ACEs) on Multiple Domains of Cognitive Functioning in Two Large-Scale Datasets of Youth*. Invited talk: Annual Meeting of the Society of Biological Psychiatry, New Orleans, LA, USA.

Mar 2022. *How do experiences in childhood shape the development of personalized brain networks and cognition?*. Developmental Cognition and Neuroimaging Lab, University of Minnesota. Virtual.

Mar 2022. *Caregiver monitoring is associated with higher performance across three domains of cognition*. BarziLab, University of Pennsylvania. Virtual.

Jan 2022. *Personalized functional brain network topography is associated with individual differences in cognition in youth.*. Invited talk: ABCD Analytics Meeting. Virtual.

Jan 2021. *Goal-Directed Attention in Healthy and Unhealthy Mental States*. Mind, Brain, Computation and Technology Seminar Series, Stanford University, Stanford, CA.

Jan 2021. *Why Attention Matters: How Active Learning Strategies and Synchronized Brain Activity Support Attention and Learning*. Invited talk: Learning the Brain Conference on "The Science of Teaching During a Pandemic: Creating Motivated, Focused, Active, Autonomous Learners" Virtual.

Sep 2020. *Characterizing impairments of goal-directed attention in mental illness*. Invited talk: Rutgers University Psychology Dept Brown Bag, Piscataway, NJ, USA.

Jun 2020. *"My brain has too many tabs open": Unpacking concentration difficulties to understand how attention changes in depression and anxiety.* STAR Lab, Stanford, CA, USA.

May 2020. *Beyond "Concentration Difficulties": Probing Attention Impairments in Depression and Anxiety Across Multiple Units of Analysis.* Society of Biological Psychiatry Annual Meeting, New York NY, USA.

Mar 2020. *Paying attention to attention in mental illness.* Invited talk: STEM Speaker Series, Cañada College, Redwood City, CA, USA.

Jun 2019. *Slowness of recovery of stress cortisol and severity of early life stress predict changes in corpus callosum diffusivity.* SNAP Lab, Stanford University, Stanford CA, USA.

May 2019. *Implicit Bias and the Leaky Pipeline*, Society of Biological Psychiatry Annual Meeting Women's Luncheon, Chicago, IL, USA.

May 2019. *Inequality in science: A close look at the data.* Invited talk and workshop given for the Graduate Training Program in Cell and Molecular Biology, Stanford, CA, USA.

Mar 2019. *Analyzing dynamics and uncovering brain states.* Stanford Mind, Brain, Computation and Technology Computational Neuroscience Journal Club, Stanford, CA, USA.

Feb 2019. *Inequality in science: A close look at the data.* Invited talk and workshop given at the Fordyce and Hershlag Laboratories, Stanford, CA, USA.

Nov 2018. *Paying attention to attention in depression.* Invited talk given at BRAVE Lab, Stanford University VA Hospital, Stanford CA, USA.

Oct 2018. *Data Blitz Presenter: The International Study to Predict Optimized Treatment for Depression* Artificial Intelligence for Precision Mental Health Event, Stanford, CA, USA.

Oct 2018. *Paying attention to attention in the brain.* Invited talk given at Leigh High School, San Jose, CA, USA.

Jul 2018. *Stanford BioAIMS: Diversity and Inclusion in Science Workshop*, Stanford, CA, USA.

Apr 2018. *Paying attention to attention in the brain.* Invited talk given at the Bay Area Society for Neuroscience Youth monthly meeting, San Jose, CA, USA.

Mar 2018). *Inequality in science: A close look at the data.* Invited talk given at the Stanford Biochemistry Journal Club, Stanford, CA, USA.

Nov 2014. *Multisensory interactions: Incidental learning and disruption.* Presented at the Undergraduate Research Colloquium, Brandeis University, Waltham, MA, USA.

Posters

** co-author; + mentored trainee*

Keller, A.S., Pines, A. R., Bertolero, M. A., Barzilay, R., Alexander-Bloch, A. F., Byington, N., Chen, A., Conan, G. M., Cui, Z., Fan, Y., Feczko, E., Hendrickson, T., Houghton, A., Larsen, B., Li, H., Miranda-Dominguez, O., Roalf, D. R., Rueter, A., Perrone, A., Shinohara, R. T., Sydnor, V. J. & Satterthwaite, T. D. (2022). Personalized functional brain network topography is associated with multiple domains of cognition in the ABCD study: A replication and extension of Cui et al. 2020. Flux Congress. Paris, FR.

Keller, A.S., Pines, A. R., Bertolero, M. A., Barzilay, R., Alexander-Bloch, A. F., Byington, N., Conan, G. M., Cui, Z., Fan, Y., Feczko, E., Hendrickson, T., Houghton, A., Larsen, B., Li, H., Miranda-Dominguez, O., Roalf, D. R., Rueter, A., Perrone, A., Shinohara, R. T., Sydnor, V. J. & Satterthwaite, T. D. (2022). Cortical networks higher along the sensorimotor-association axis yield more accurate out-of-sample predictions of cognitive performance across three domains. Gradients Pre-OHBM Workshop. Cambridge, UK.

Warthen, K., **Keller, A.S.** & Williams, L. M. (2022). Reduced stability of dynamic functional connectivity across and within neural circuits is associated with lower effort-related behavioral drive in a transdiagnostic sample of depression and anxiety. Society of Biological Psychiatry. 91(9), S227.

Keller, A.S., Li, J.*+, Qiu, S.*+, Berwian, I., Huys, Q. & Williams, L. M. (2021). Nevertheless, She Persisted: Reward Responsivity and Effort Expenditure Contribute to Persistence on a Difficult Cognitive Task in Individuals With Mood and Anxiety Symptoms, With Identifiable Neural Correlates. Society of Biological Psychiatry, 89(9), S336-S337.

Holt-Gosselin, B.+, **Keller, A.S.**, Chesnut, M. & Williams, L. M. (2021). Default Mode Network Moderates the Relationship Between Lifestyle Changes and Natural Improvements in Clinical Symptoms Over Time in Untreated Participants. Society of Biological Psychiatry, 89(9), S111.

Chilver, M., **Keller, A.S.**, Park, H., Jamshidi, J., Montalto, A., Schofield, P., Clark, R., Harmon-Jones, E., Williams, L. M. & Gatt, J. (2021). Distinct Electrophysiological Markers of Mental Wellbeing and Mental Illness Symptoms in 422 Healthy Adults. Society of Biological Psychiatry, 89(9), S163-164.

Keller, A.S., Holt-Gosselin, B.*+, Ling, R.*+, Williams, L. M. (2020). Unpacking "Concentration Difficulties": Impaired spatial attention partially mediates the association between early life stress and anxiety in adulthood with specific neural correlates. Annual Meeting of the American College of Neuro-Psychopharmacology (ACNP), Virtual Conference.

Hack, L. M., **Keller, A.S.**, Warthen, K. G., Whicker, C. L., Williams, L. M. (2020). The effect of selective D3 agonism on anhedonia symptoms and reward neurocircuitry in subjects with MDD and prominent anhedonia. Annual Meeting of the American College of Neuro-Psychopharmacology (ACNP), Virtual Conference.

Hack, L. M.*, **Keller, A.S.***, Whicker, C. L., Williams, L. M. (2020). Mechanistic trial evaluating the effect of repetitive transcranial magnetic stimulation on RDoC constructs in treatment-resistant depression. Society for Biological Psychiatry, 87(9), S412-S413.

Keller, A.S., Ball, T. M., Cocjin, J. B., Jagadeesh, A. V., Bugatus, L., Grill-Spector, K., Williams, L. M. (2019). Mechanisms of goal-directed attention in healthy and unhealthy mental states. Department of Defense National Defense Science and Engineering Graduate (NDSEG) Fellowship Conference, San Diego, CA, USA.

Keller, A.S., Qiu, S.*+, Li, J.*+,. & Williams, L. M. (2019). Modeling attention impairments in Major Depression. Computational Cognitive Neuroscience, Berlin, Germany.

Keller, A.S.*, Ling, R.*+, Holt-Gosselin, B.+ & Williams, L. M. (2019). Attention and working memory in mental illness: Experimental design and preliminary results. Stanford Bio-X Symposium, Stanford CA, USA.

Qiu, S.*+, Li, J.*+, **Keller, A. S.** & Williams, L. M. (2019). Modeling attention impairments in Major Depression. Stanford Bio-X Symposium, Stanford CA, USA.

Keller, A. S., Ball, T. M., Cocjin, J. B., Jagadeesh, A. V., Bugatus, L., Grill-Spector, K. & Williams, L. M. (2019) Residual correlations reveal top-down selective attention mechanisms in healthy and depressed adults. Organization for Human Brain Mapping, Rome, Italy.

Keller, A. S., Ball, T. M. & Williams, L. M. (2019) Deep phenotyping of attention impairments and the "Inattention Biotype" in Major Depressive Disorder. Society for Biological Psychiatry, Chicago, IL, USA.

Tally, S.+, Holt-Gosselin, B.+, **Keller, A. S.**, Staveland, B. R., Williams, N., Suppes, P., Ostacher, M. & Williams, L. M. (2019). Effects of dopamine agonist and TMS treatments on anhedonic depression. Bio-X Symposium, Stanford, CA, USA.

Keller, A. S.*, Cocjin, J. C.*, Jagadeesh, A. J.*, Bugatus, L., & Grill-Spector, K. (2018). Selective attention influences visual object category representations across human cortex. Society for Neuroscience (SfN), San Diego, CA, USA.

Keller, A. S., Ball, T. M. & Williams, L. M. (2018). Fronto-parietal hypo-connectivity and reduced alpha oscillations characterize the "Inattention Biotype" in Major Depressive Disorder. Stanford Neurosciences Institute, Stanford, CA, USA.

Keller, A. S., Korgaonkar, M. & Williams, L. M. (2018) Feature-based selective attention as a biomarker for impaired cognition in depression. Society for Biological Psychiatry, New York, NY, USA.

Keller, A. S., Payne, L. & Sekuler, R. (2016) Multisensory divided attention: Role of theta oscillations. Cognitive Neuroscience Society, New York, NY, USA.

Keller, A. S., Payne, L. & Sekuler, R. (2015) Fronto-central theta oscillations during multisensory divided attention. Brandeis Division of Sciences Summer Undergraduate Research Poster Session, Waltham, MA, USA.

Keller, A. S., Payne, L. & Sekuler, R. (2015) When multiple modalities require attention, theta steps up to the plate. NSF inter-Science of Learning Center Conference, San Diego, CA, USA.

Keller, A. S., Payne, L. & Sekuler, R. (2015) When multiple modalities require attention, theta steps up to the plate. Cognitive Neuroscience Society, San Francisco, CA, USA.

Keller, A. S., Payne, L. & Sekuler, R. (2014). Theta oscillations drive multisensory divided attention. Brandeis Division of Sciences Summer Undergraduate Research Poster Session, Waltham, MA, USA.

Keller, A. S., Aizenman, A. M. & Sekuler, R. (2014). Multisensory interactions: Incidental learning and disruption. Gordon Research Conference: Neurobiology of Cognition, Bethel, ME, USA.

Keller, A. S. & Sekuler, R. (2014). Ignored sounds infiltrate perception of rapid visual sequences. Brandeis University Undergraduate Science Symposium, Waltham, MA, USA.

Keller, A. S., Aizenman, A. M. & Sekuler, R. (2013). Multisensory learning: Feedback does not matter. Brandeis Division of Sciences Summer Undergraduate Research Poster Session, Waltham, MA, USA.

Teaching Experience

Spring 2022	**BIBB 421: Human Brain Imaging**, Instructor	*UPenn*
Spring 2022	**PGY-2 Neuroscience Didactics**, Guest Lecturer	*UPenn*
Spring 2021	**PSYCH 196b: Foundational Topics in Neuroscience**, Teaching Assistant	*Stanford*
Winter 2021	**PSYCH 196a: Neuroscience Research**, Instructor	*Stanford*
Fall 2020	**Stanford Psychology PhD Program Bootcamp**, Instructor	*Stanford*
Fall 2019	**Stanford Psychology Dept EEG Laboratory**, Teaching Assistant	*Stanford*
Fall 2019	**NSUR 249: NeuroTech: Experimental Immersion in Neuroscience**, Teaching Assistant	*Stanford*
Fall 2018	**PSYCH 30: Introduction to Perception**, Teaching Assistant	*Stanford*
Fall 2017	**NEPR 299: Stanford Intensive Neurosciences Bootcamp**, Teaching Assistant	*Stanford*
Fall 2017	**PSYCH 246: Cognitive Neuroscience Friday Seminar**, Guest Lecturer	*Stanford*
Winter 2017	**BIOS 225: Diversity and Inclusion in Science**, Teaching Assistant	*Stanford*
Fall 2015	**Dept of Academic Services**, Undergraduate Group Study Tutor	*Brandeis*
Fall 2015	**NPSY22B: Introduction to Cognitive Neuroscience**, Guest Lecturer	*Brandeis*
Fall 2014	**NPSY22B: Introduction to Cognitive Neuroscience**, Guest Lecturer	*Brandeis*

Mentorship

2022-pres **Kevin Sun**, Graduate Student, University of Pennsylvania
2022-pres **Mārtiņš Gataviņš**, Undergraduate Research Assistant, University of Pennsylvania
2022-pres **Madeleine Seitz**, Research Coordinator, University of Pennsylvania
2022-pres **Alisha Shetty**, Undergraduate Research Assistant, University of Pennsylvania
2022-pres **Eren Kafadar**, Graduate Student, University of Pennsylvania
2019-2021 **Ruth Ling**, Undergraduate Research Assistant, Stanford University
2019-2021 **Bailey Holt-Gosselin**, Clinical Research Coordinator, Stanford University
2018-2021 **Jason Li**, AI for Mental Health Researcher, Stanford University
2018-2021 **Helen Qiu**, AI for Mental Health Researcher, Stanford University
2017-2019 **Serena Tally**, Clinical Research Coordinator, Stanford University

Outreach & Professional Development

Service and Outreach

2022-Pres **Flux Society**, Communications Committee
2022-Pres **UPenn DiVE In**, Steering Committee Member, Data and Outreach Committee Lead
2017-2021 **NeuWrite West**, Co-President, Writer, Editor
2017-2021 **Stanford Science Penpals**, Vice President, School Coordinator, Neuroscience Liaison
2018-2021 **Neuroscience Student Network**, Workshop Leader
2020-2021 **Stanford Neuroscience Application Assistance Program (SNAAP)**, Mentor
2020-2021 **Stanford Biosciences Student Association (SBSA)**, Mentor
2021 **Wu Tsai Neuroscience Seminar Speaker Selection Committee**, Committee Member
2021 **Stanford Neurosciences Program Director Selection Committee**, Student Representative
2017-2020 **Stanford Brain Day**, Middle School Classroom Instructor
2019 **Stanford Community College Visit Day**, Volunteer
2018 **Stanford Mind, Brain, Computation and Technology Symposium**, Student Organizer
2016-2018 **Stanford SPLASH**, Instructor, Volunteer
2017-2019 **Stanford Neurosciences Program Committee**, Student Representative
2017-2018 **Stanford Neurosciences Program**, Communications Representative
2015-2016 **Brandeis Students to End Alzheimer's Disease**, Founder, Co-President

Peer Review

Biological Psychiatry
Psychological Medicine
Cortex
JAMA Psychiatry
Scientific Reports
Neuropsychopharmacology
NeuroImage
PNAS

Professional Memberships

Society of Biological Psychiatry
Flux Society
Society for Neuroscience
Cognitive Neuroscience Society
Organization for Human Brain Mapping