



Andrew D. Huberman

Associate Professor of Neurobiology and, by courtesy, of Psychiatry and Behavioral Sciences

Bio

ACADEMIC APPOINTMENTS

- Associate Professor, Neurobiology
- Associate Professor (By courtesy), Psychiatry and Behavioral Sciences
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Associate Professor, Stanford School of Medicine, (2016- present)
- Assistant Professor, University of California, San Diego, (2011-2015)

HONORS AND AWARDS

- Cogan Award for Contributions to Vision Science and Ophthalmology, ARVO (2017)
- Pew Biomedical Scholar Award, Pew Charitable Trusts (2013-2017)
- McKnight Neuroscience Scholar Award, McKnight Endowment Fund (2013-2016)
- Catalyst for a Cure Investigator, Glaucoma Research Foundation (2012- present)
- Helen Hay Whitney Postdoctoral Fellow, HHWF Foundation (2006-2009)
- Allan G. Marr Prize for Best Ph.D. Dissertation, University of California, Davis (2005)
- ARCS Foundation Graduate Fellowship Award, ARCS Foundation (2003)
- Graduation with Honors and Distinction in Major, University of California, Santa Barbara (1998)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Wu-Tsai Neurosciences Seminar Committee Chair, Stanford University (2021 - 2022)
- Faculty Search Committee, Neurobiology/Molecular Neuroscience, Stanford School of Medicine (2019 - 2020)
- Faculty Search Committee, Neurosurgery Chair, Stanford School of Medicine (2019 - 2020)
- Within-Department Tenure Review Committee, Neurobiology, Stanford School of Medicine (2019 - 2019)
- Editorial Board, Faculty of 1000 (2018 - present)
- Faculty Search Committee, Neurobiology/Molecular Neuroscience, Stanford School of Medicine (2018 - 2019)
- Editorial Board, Neural Development (2016 - present)
- Editorial Board, Cell Reports (2016 - 2022)

- Editorial Board, *Current Opinion in Neurobiology* (2016 - 2018)
- Within-Department Tenure Review Committee, Neurobiology, Stanford School of Medicine (2016 - 2016)
- Editorial Board, *The Journal of Comparative Neurology* (2015 - present)
- Research Committee Co-chair, Neurosciences, University of California, San Diego (2014 - 2015)
- Associate Editor: Systems/Circuits, *The Journal of Neuroscience* (2013 - 2018)
- Editorial Board, *Current Biology* (2011 - present)
- Faculty Recruitment Committee, Neurobiology, University of California, San Diego (2011 - 2014)
- Seminar Committee, Neurobiology Section Chair, University of California, San Diego (2011 - 2013)
- Neuroscience Graduate Program Admissions Committee, University of California, San Diego (2011 - 2012)

PROFESSIONAL EDUCATION

- Postdoc, Stanford University , Neuroscience (2010)
- PhD, University of California, Davis , Neuroscience (2004)
- MA, University of California, Berkeley , Psychology (2000)
- BA, University of California, Santa Barbara , Psychology (1998)

LINKS

- Huberman Lab Website: <https://hubermanlab.stanford.edu/>
- Twitter: <https://twitter.com/hubermanlab>
- LinkedIn: <https://www.linkedin.com/in/andrew-huberman/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

In 2017, we developed a virtual reality platform to investigate the neural and autonomic mechanisms contributing to fear and anxiety. That involved capturing 360-degree videos of various fear-provoking situations in real life for in-lab VR movies, such as heights and claustrophobia, as well as unusual scenarios like swimming in open water with great white sharks. The primary objective of our VR platform is to develop new tools to help people better manage stress, anxiety and phobias in real-time, as an augment to in-clinic therapies.

In May 2018, we reported the discovery of two novel mammalian brain circuits as a Research Article published in *Nature*. One circuit promotes fear and anxiety-induced paralysis, while the other fosters confrontational reactions to threats. This led to ongoing research into the involvement of these brain regions in anxiety-related disorders such as phobias and generalized anxiety in humans.

In 2020, we embarked on a collaborative effort with Dr. David Spiegel's laboratory in the Stanford Department of Psychiatry and Behavioral Sciences, aimed to explore how specific respiration patterns synergize with the visual system to influence autonomic arousal and stress, and other brain states, including sleep.

In 2023, the first results of that collaboration were published as a randomized controlled trial in *Cell Reports Medicine*, demonstrating that specific brief patterns of deliberate respiration are particularly effective in alleviating stress and enhancing mood, and improving sleep.

In a 2021, our collaboration with Dr. Edward Chang, professor and chair of the Department of Neurological Surgery at the University of California, San Francisco (UCSF), was published in *Current Biology*, revealing that specific patterns of insular cortex neural activity may be linked to, and potentially predict, anxiety responses.

CLINICAL TRIALS

- Psychophysiological Effects of Controlled Respiration and Mindfulness, Not Recruiting

Teaching

COURSES

2022-23

- The Nervous System: NBIO 206 (Win)

2021-22

- The Nervous System: NBIO 206 (Win)

2020-21

- The Nervous System: NBIO 206 (Win)

Publications

PUBLICATIONS

- **Postsynaptic neuronal activity promotes regeneration of retinal axons.** *Cell reports*
Varadarajan, S. G., Wang, F., Dhande, O. S., Le, P., Duan, X., Huberman, A. D.
2023; 42 (5): 112476
- **Brief structured respiration practices enhance mood and reduce physiological arousal.** *Cell reports. Medicine*
Balban, M. Y., Neri, E., Kogon, M. M., Weed, L., Nouriani, B., Jo, B., Holl, G., Zeitzer, J. M., Spiegel, D., Huberman, A. D.
2023: 100895
- **Corrigendum to "Characterization of non-alpha retinal ganglion cell injury responses reveals a possible block to restoring ipRGC function".** *Experimental neurology*
Hunyara, J. L., Foshe, S., Varadarajan, S. G., Gribble, K. D., Huberman, A. D., Kolodkin, A. L.
2023; 359: 114256
- **Characterization of non-alpha retinal ganglion cell injury responses reveals a possible block to restoring ipRGC function.** *Experimental neurology*
Hunyara, J. L., Foshe, S., Varadarajan, S. G., Gribble, K. D., Huberman, A. D., Kolodkin, A. L.
2022: 114176
- **Probing the role of retinorecipient target cells in visual circuit regeneration**
Varadarajan, S., Dhande, O., Le, P., Huberman, A.
ASSOC RESEARCH VISION OPHTHALMOLOGY INC.2022
- **Central nervous system regeneration.** *Cell*
Varadarajan, S. G., Hunyara, J. L., Hamilton, N. R., Kolodkin, A. L., Huberman, A. D.
2022; 185 (1): 77-94
- **Thalamus: Then and now.** *The Journal of comparative neurology*
Guido, W., Huberman, A.
1800
- **Divergent outputs of the ventral lateral geniculate nucleus mediate visually evoked defensive behaviors.** *Cell reports*
Salay, L. D., Huberman, A. D.
2021; 37 (1): 109792
- **Human Responses to Visually Evoked Threat.** *Current biology : CB*
Yilmaz Balban, M. n., Cafaro, E. n., Saue-Fletcher, L. n., Washington, M. J., Bijanzadeh, M. n., Lee, A. M., Chang, E. F., Huberman, A. D.
2020
- **Neuroscience: A Chromatic Retinal Circuit Encodes Sunrise and Sunset for the Brain.** *Current biology : CB*

- Rivera, A. M., Huberman, A. D.
2020; 30 (7): R316–R318
- **Neurotoxic Reactive Astrocytes Drive Neuronal Death after Retinal Injury.** *Cell reports*
Guttenplan, K. A., Stafford, B. K., El-Danaf, R. N., Adler, D. I., Münch, A. E., Weigel, M. K., Huberman, A. D., Liddelow, S. A.
2020; 31 (12): 107776
 - **Sight restored by turning back the epigenetic clock.** *Nature*
Huberman, A. D.
2020; 588 (7836): 34–36
 - **Molecular Fingerprinting of On-Off Direction-Selective Retinal Ganglion Cells Across Species and Relevance to Primate Visual Circuits** *JOURNAL OF NEUROSCIENCE*
Dhande, O. S., Stafford, B. K., Franke, K., El-Danaf, R., Percival, K. A., Phan, A. H., Li, P., Hansen, B. J., Nguyen, P. L., Berens, P., Taylor, W., Callaway, E., Euler, et al
2019; 39 (1): 78-95
 - **Fear: It's All in Your Line of Sight.** *Current biology : CB*
Yilmaz, M. n., Huberman, A. D.
2019; 29 (23): R1232–R1234
 - **Sub-topographic maps for regionally enhanced analysis of visual space in the mouse retina** *JOURNAL OF COMPARATIVE NEUROLOGY*
El-Danaf, R. N., Huberman, A. D.
2019; 527 (1): 259-269
 - **Introduction to retinal special issue I.** *The Journal of comparative neurology*
Huberman, A. D., Berson, D. M.
2019; 527 (1): 7–8
 - **Dedication of Retinal Special Issue to: Harvey J. Karten, MD** *JOURNAL OF COMPARATIVE NEUROLOGY*
Huberman, A. D.
2019; 527 (1): 9–10
 - **An Unbiased View of Neural Networks: More than Meets the Eye** *NEURON*
Jung, H., Huberman, A. D.
2018; 100 (5): 1019–21
 - **An Unbiased View of Neural Networks: More than Meets the Eye.** *Neuron*
Jung, H., Huberman, A. D.
2018; 100 (5): 1019-1021
 - **Assembly and repair of eye-to-brain connections** *CURRENT OPINION IN NEUROBIOLOGY*
Varadarajan, S. G., Huberman, A. D.
2018; 53: 198-209
 - **Synaptic Convergence Patterns onto Retinal Ganglion Cells Are Preserved despite Topographic Variation in Pre- and Postsynaptic Territories.** *Cell reports*
Yu, W., El-Danaf, R. N., Okawa, H., Pacholec, J. M., Matti, U., Schwarz, K., Odermatt, B., Dunn, F. A., Lagnado, L., Schmitz, F., Huberman, A. D., Wong, R. O.
2018; 25 (8): 2017
 - **Synaptic Convergence Patterns onto Retinal Ganglion Cells Are Preserved despite Topographic Variation in Pre- and Postsynaptic Territories** *CELL REPORTS*
Yu, W., El-Danaf, R. N., Okawa, H., Pacholec, J. M., Matti, U., Schwarz, K., Odermatt, B., Dunn, F. A., Lagnado, L., Schmitz, F., Huberman, A. D., Wong, R. L.
2018; 25 (8): 2017–+
 - **Molecular fingerprinting of On-Off direction selective retinal ganglion cells across species and relevance to primate visual circuits.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
Dhande, O. S., Stafford, B. K., Franke, K., El-Danaf, R., Percival, K. A., Phan, A. H., Li, P., Hansen, B. J., Nguyen, P. L., Berens, P., Taylor, W. R., Callaway, E., Euler, et al
2018

- **Assembly and repair of eye-to-brain connections.** *Current opinion in neurobiology*
Varadarajan, S. G., Huberman, A. D.
2018; 53: 198–209
- **Sub-topographic maps for regionally enhanced analysis of visual space in the mouse retina.** *The Journal of comparative neurology*
El-Danaf, R. N., Huberman, A. D.
2018
- **Ben Barres (1954-2017) OBITUARY** *NATURE*
Huberman, A. D.
2018; 553 (7688): 282
- **A midline thalamic circuit determines reactions to visual threat.** *Nature*
Salay, L. D., Ishiko, N. n., Huberman, A. D.
2018
- **Uniformity from Diversity: Vast-Range Light Sensing in a Single Neuron Type** *CELL*
Varadarajan, S. G., Huberman, A. D.
2017; 171 (4): 738–40
- **Developmental mechanisms for establishing functional non-image-forming visual circuits**
Dhande, O. S., Phan, A. H., Seabrook, T. A., Nguyen, P. L., Wang, J. T., Huberman, A.
ASSOC RESEARCH VISION OPHTHALMOLOGY INC.2017
- **Distinct retinal ganglion cell subtypes exhibit diverse topographic characteristics across the mouse retina**
El-Danaf, R., Huberman, A.
ASSOC RESEARCH VISION OPHTHALMOLOGY INC.2017
- **Signal Integration in Thalamus: Labeled Lines Go Cross-Eyed and Blurry.** *Neuron*
Stafford, B. K., Huberman, A. D.
2017; 93 (4): 717-720
- **Regenerating optic pathways from the eye to the brain.** *Science (New York, N.Y.)*
Laha, B. n., Stafford, B. K., Huberman, A. D.
2017; 356 (6342): 1031–34
- **Architecture, Function, and Assembly of the Mouse Visual System.** *Annual review of neuroscience*
Seabrook, T. A., Burbridge, T. J., Crair, M. C., Huberman, A. D.
2017; 40: 499–538
- **Strict Independence of Parallel and Poly-synaptic Axon-Target Matching during Visual Reflex Circuit Assembly.** *Cell reports*
Seabrook, T. A., Dhande, O. S., Ishiko, N. n., Wooley, V. P., Nguyen, P. L., Huberman, A. D.
2017; 21 (11): 3049–64
- **Cortico-fugal output from visual cortex promotes plasticity of innate motor behaviour.** *Nature*
Liu, B., Huberman, A. D., Scanziani, M.
2016; 538 (7625): 383-387
- **Neural activity promotes long-distance, target-specific regeneration of adult retinal axons.** *Nature neuroscience*
Lim, J. A., Stafford, B. K., Nguyen, P. L., Lien, B. V., Wang, C., Zukor, K., He, Z., Huberman, A. D.
2016; 19 (8): 1073-1084
- **Report on the National Eye Institute Audacious Goals Initiative: Regenerating the Optic Nerve.** *Investigative ophthalmology & visual science*
Goldberg, J. L., Guido, W., For The Agi Workshop Participants
2016; 57 (3): 1271-1275
- **Life goes by: a visual circuit signals perceptual-motor mismatch** *NATURE NEUROSCIENCE*
Ishiko, N., Huberman, A. D.
2016; 19 (2): 177-179

- **BLINDNESS Assassins of eyesight** *NATURE*
Huberman, A. D., El-Danaf, R. N.
2015; 527 (7579): 456-457
- **Cell type-specific manipulation with GFP-dependent Cre recombinase** *NATURE NEUROSCIENCE*
Tang, J. C., Rudolph, S., Dhande, O. S., Abraira, V. E., Choi, S., Lapan, S. W., Drew, I. R., Drokhlyansky, E., Huberman, A. D., Regehr, W. G., Cepko, C. L.
2015; 18 (9): 1334-?
- **When Visual Circuits Collide: Motion Processing in the Brain.** *Cell*
Salay, L. D., Huberman, A. D.
2015; 162 (2): 241-243
- **Cortical Cliques: A Few Plastic Neurons Get All the Action** *NEURON*
Seabrook, T. A., Huberman, A. D.
2015; 86 (5): 1113-1116
- **Contactin-4 Mediates Axon-Target Specificity and Functional Development of the Accessory Optic System** *NEURON*
Osterhout, J. A., Stafford, B. K., Nguyen, P. L., Yoshihara, Y., Huberman, A. D.
2015; 86 (4): 985-999
- **Functional Assembly of Accessory Optic System Circuitry Critical for Compensatory Eye Movements.** *Neuron*
Sun, L. O., Brady, C. M., Cahill, H., Al-Khindi, T., Sakuta, H., Dhande, O. S., Noda, M., Huberman, A. D., Nathans, J., Kolodkin, A. L.
2015
- **Characteristic Patterns of Dendritic Remodeling in Early-Stage Glaucoma: Evidence from Genetically Identified Retinal Ganglion Cell Types** *JOURNAL OF NEUROSCIENCE*
El-Danaf, R. N., Huberman, A. D.
2015; 35 (6): 2329-2343
- **So many pieces, one puzzle: cell type specification and visual circuitry in flies and mice** *GENES & DEVELOPMENT*
Wernet, M. F., Huberman, A. D., Desplan, C.
2014; 28 (23): 2565-2584
- **Birthdate and Outgrowth Timing Predict Cellular Mechanisms of Axon Target Matching in the Developing Visual Pathway** *CELL REPORTS*
Osterhout, J. A., El-Danaf, R. N., Nguyen, P. L., Huberman, A. D.
2014; 8 (4): 1006-1017
- **A dedicated circuit links direction-selective retinal ganglion cells to the primary visual cortex** *NATURE*
Cruz-Martin, A., El-Danaf, R. N., Osakada, F., Sriram, B., Dhande, O. S., Nguyen, P. L., Callaway, E. M., Ghosh, A., Huberman, A. D.
2014; 507 (7492): 358-?
- **Visual Circuits: Mouse Retina No Longer a Level Playing Field** *CURRENT BIOLOGY*
Dhande, O. S., Huberman, A. D.
2014; 24 (4): R155-R156
- **Retinal ganglion cell maps in the brain: implications for visual processing** *CURRENT OPINION IN NEUROBIOLOGY*
Dhande, O. S., Huberman, A. D.
2014; 24: 133-142
- **Genetic Dissection of Retinal Inputs to Brainstem Nuclei Controlling Image Stabilization** *JOURNAL OF NEUROSCIENCE*
Dhande, O. S., Estevez, M. E., Quattrochi, L. E., El-Danaf, R. N., Nguyen, P. L., Berson, D. M., Huberman, A. D.
2013; 33 (45): 17797-17813
- **Diverse Visual Features Encoded in Mouse Lateral Geniculate Nucleus** *JOURNAL OF NEUROSCIENCE*
Piscopo, D. M., El-Danaf, R. N., Huberman, A. D., Niell, C. M.
2013; 33 (11): 4642-4656
- **Transsynaptic Tracing with Vesicular Stomatitis Virus Reveals Novel Retinal Circuitry** *JOURNAL OF NEUROSCIENCE*
Beier, K. T., Borghuis, B. G., El-Danaf, R. N., Huberman, A. D., Demb, J. B., Cepko, C. L.
2013; 33 (1): 35-51

- **Wiring visual circuits, one eye at a time** *NATURE NEUROSCIENCE*
El Danaf, R. N., Huberman, A. D.
2012; 15 (2): 172-174
- **Visual Cognition: Rats Compare Shapes Among the Crowd** *CURRENT BIOLOGY*
Cruz-Martin, A., Huberman, A. D.
2012; 22 (1): R18-R20
- **What can mice tell us about how vision works?** *TRENDS IN NEUROSCIENCES*
Huberman, A. D., Niell, C. M.
2011; 34 (9): 464-473
- **Cadherin-6 Mediates Axon-Target Matching in a Non-Image-Forming Visual Circuit** *NEURON*
Osterhout, J. A., Josten, N., Yamada, J., Pan, F., Wu, S., Nguyen, P. L., Panagiotakos, G., Inoue, Y. U., Egusa, S. F., Volgyi, B., Inoue, T., Bloomfield, S. A., Barres, et al
2011; 71 (4): 632-639
- **Pathway-Specific Genetic Attenuation of Glutamate Release Alters Select Features of Competition-Based Visual Circuit Refinement** *NEURON*
Koch, S. M., Dela Cruz, C. G., Hnasko, T. S., Edwards, R. H., Huberman, A. D., Ullian, E. M.
2011; 71 (2): 235-242
- **Transgenic Mice Reveal Unexpected Diversity of On-Off Direction-Selective Retinal Ganglion Cell Subtypes and Brain Structures Involved in Motion Processing** *JOURNAL OF NEUROSCIENCE*
Rivlin-Etzion, M., Zhou, K., Wei, W., Elstrott, J., Nguyen, P. L., Barres, B. A., Huberman, A. D., Feller, M. B.
2011; 31 (24): 8760-8769
- **The Down Syndrome Critical Region Regulates Retinogeniculate Refinement** *JOURNAL OF NEUROSCIENCE*
Blank, M., Fuerst, P. G., Stevens, B., Nouri, N., Kirkby, L., Warriar, D., Barres, B. A., Feller, M. B., Huberman, A. D., Burgess, R. W., Garner, C. C.
2011; 31 (15): 5764-5776
- **Emergence of Lamina-Specific Retinal Ganglion Cell Connectivity by Axon Arbor Retraction and Synapse Elimination** *JOURNAL OF NEUROSCIENCE*
Cheng, T., Liu, X., Faulkner, R. L., Stephan, A. H., Barres, B. A., Huberman, A. D., Cheng, H.
2010; 30 (48): 16376-16382
- **Molecular and Cellular Mechanisms of Lamina-specific Axon Targeting** *COLD SPRING HARBOR PERSPECTIVES IN BIOLOGY*
Huberman, A. D., Clandinin, T. R., Baier, H.
2010; 2 (3)
- **MILESTONES AND MECHANISMS FOR GENERATING SPECIFIC SYNAPTIC CONNECTIONS BETWEEN THE EYES AND THE BRAIN** *INVERTEBRATE AND VERTEBRATE EYE DEVELOPMENT*
Josten, N. J., Huberman, A. D.
2010; 93: 229-259
- **Genetic Identification of an On-Off Direction-Selective Retinal Ganglion Cell Subtype Reveals a Layer-Specific Subcortical Map of Posterior Motion** *NEURON*
Huberman, A. D., Wei, W., Elstrott, J., Stafford, B. K., Feller, M. B., Barres, B. A.
2009; 62 (3): 327-334
- **Architecture and activity-mediated refinement of axonal projections from a mosaic of genetically identified retinal ganglion cells** *NEURON*
Huberman, A. D., Manu, M., Koch, S. M., Susman, M. W., Lutz, A. B., Ullian, E. M., Baccus, S. A., Barres, B. A.
2008; 59 (3): 425-438
- **Mechanisms underlying development of visual maps and receptive fields** *ANNUAL REVIEW OF NEUROSCIENCE*
Huberman, A. D., Feller, M. B., Chapman, B.
2008; 31: 479-509
- **The classical complement cascade mediates CNS synapse elimination** *CELL*
Stevens, B., Allen, N. J., Vazquez, L. E., Howell, G. R., Christopherson, K. S., Nouri, N., Micheva, K. D., Mehalow, A. K., Huberman, A. D., Stafford, B., Sher, A., Litke, A. M., Lambris, et al
2007; 131 (6): 1164-1178

- **Mechanisms of eye-specific visual circuit development** *CURRENT OPINION IN NEUROBIOLOGY*
Huberman, A. D.
2007; 17 (1): 73-80
- **Spontaneous retinal activity mediates development of ocular dominance columns and binocular receptive fields in V1** *NEURON*
Huberman, A. D., Speer, C. M., Chapman, B.
2006; 52 (2): 247-254
- **Neuronal pentraxins mediate synaptic refinement in the developing visual system** *JOURNAL OF NEUROSCIENCE*
Bjartmar, L., Huberman, A. D., Ullian, E. M., Renteria, R. C., Liu, X., Xu, W., Prezioso, J., Susman, M. W., Stellwagen, D., Stokes, C. C., Cho, R., Worley, P., Malenka, et al
2006; 26 (23): 6269-6281
- **Dynamics of spontaneous activity in the fetal macaque retina during development of retinogeniculate pathways** *JOURNAL OF NEUROSCIENCE*
Warland, D. K., Huberman, A. D., Chalupa, L. M.
2006; 26 (19): 5190-5197
- **Nob mice wave goodbye to eye-specific segregation** *NEURON*
Huberman, A. D.
2006; 50 (2): 175-177
- **Target-derived cues instruct synaptic differentiation** *JOURNAL OF NEUROSCIENCE*
Huberman, A. D.
2006; 26 (4): 1063-1064
- **Ephrin-As mediate targeting of eye-specific projections to the lateral geniculate nucleus** *NATURE NEUROSCIENCE*
Huberman, A. D., Murray, K. D., Warland, D. K., Feldheim, D. A., Chapman, B.
2005; 8 (8): 1013-1021
- **Early and rapid targeting of eye-specific axonal projections to the dorsal lateral geniculate nucleus in the fetal macaque** *JOURNAL OF NEUROSCIENCE*
Huberman, A. D., Dehay, C., Berland, M., Chalupa, L. M., Kennedy, H.
2005; 25 (16): 4014-4023
- **Decoupling eye-specific segregation from lamination in the lateral geniculate nucleus** *JOURNAL OF NEUROSCIENCE*
Huberman, A. D., Stellwagen, D., Chapman, B.
2002; 22 (21): 9419-9429