BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Brewer, Alyssa A.

eRA COMMONS USER NAME (credential, e.g., agency login): ALYSSABREWER

POSITION TITLE: Associate Professor of Cognitive Sciences and Language Science (*by courtesy*)

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Stanford University, Stanford, CA	B.S., H.	06/1996	Biological Sciences, with Honors
Stanford University, Stanford, CA	B.A., IHn.	06/1996	Comparative Literature, with Interdisciplinary Honors in the Humanities
Stanford University, Neurosciences Graduate Program, Stanford, CA	Ph.D.	09/2005	Neurosciences
Stanford University School of Medicine, Stanford, CA	M.D.	06/2007	Medicine
Stanford University, Stanford, CA		06/2007	Postdoctoral Researcher Visual Neuroscience

A. **Personal Statement**

I have had a lifelong interest in disease and the brain. To foster a career spanning both these interests, I completed a dual degree M.D./Ph.D. program at Stanford University to become a physician-scientist. During my graduate training in Neurosciences there, I discovered and characterized three new visual areas in the human brain, made the first visual field map measurements with fMRI in macaque cortex, and developed the proposal of visual field map clusters as a fundamental, organizing principle of human visual cortex. I was also an instrumental member on several collaborative projects that characterized the variability of visual field maps in human posterior occipital cortex and investigated developmental plasticity in human rod monochromats, cortical plasticity induced by retinal lesions in adult macaque, and sight-recovery in adult human. During my postdoctoral work at Stanford, I received training in diffusion tensor imaging (DTI) through a project investigating white matter changes in temporal lobe epilepsy and collaborated on a project using DTI to measure the inter-hemispheric connectivity of human primary visual cortex. To complement my neuroscience graduate and postdoctoral training, I simultaneously completed medical school with a concentration of clinical experiences in neurology and neurosurgery. With this extensive background spanning basic and clinical sciences, I am exceptionally qualified for my career in neuroscience research.

In my position as an Associate Professor at the University of California, Irvine, I am pursuing several lines of research arising from this training. My lab currently focuses on visual, auditory, and multi-sensory neuroscience, using behavioral, genetic, and high resolution neuroimaging techniques to investigate questions ranging from the fundamental organization of human visual and auditory cortex in healthy and disease states, to plasticity in visual, auditory, and sensorimotor regions, to genetic and neuromodulatory effects on behavior. In addition, I have been involved in the development and application of the cutting-edge neuroimaging software from my graduate lab that uses advances in phase-encoded fMRI measurements and population receptive field modeling. I then apply these state-of-the-art measurements of auditory and visual cortex to studies of cortical reorganization and recovery. I am supported in my work by my postdoctoral, graduate, and undergraduate student trainees within the Department of Cognitive Sciences, as well as by both my colleagues within my department and my collaborators across the world, who allow for a breadth of complementary views and feedback.

Ongoing and recently completed projects that I would like to highlight include:

- NSF #1329255, Cognitive Neuroscience

PI Brewer; 9/2013 –06/2017
Acoustic Foundations of Speech Perception

- NSF #1413417, Mathematical Biology Program

PI Wang; 7/2014 – 6/2017 [Co-I]
Quantifying Retinotopic Mapping by Conformal Geometry

- Translational Collaborative Discovery Grant Award, UCI/NIH

PI Brewer; 4/2012 – 3/2013
Visual rehabilitation after stroke: harnessing cortical plasticity for therapeutic interventions.

- NIH #F30 NS044759, NINDS

PI Brewer; 9/2002-6/2006
Human ventral occipito-temporal cortex

I have ~$91,000 available of unallocated startup and intramural funds in addition to pending grants.

1) **A.A. Brewer**, B. Barton. (2016) Maps of the Auditory Cortex. ***Annual Review of Neuroscience***. 39(1).
2) B. Barton, **A.A. Brewer**. (2015) Human Auditory Cortex. In ***Neurobiology of Language***, Eds. G. Hickok, S. Small. Elsevier. ISBN 978-0-12-407794-2. (Cambridge: Academic Press, Elsevier) Ch. 5, pp. 49-58
3) B. Barton, J.H. Venezia, K. Saberi, G. Hickok, **A.A. Brewer**. (2012) Orthogonal Acoustic Dimensions Define Auditory Field Maps in Human Cortex ***Proceedings of the National Academy of Sciences*** 109(50),20738-43
4) **A.A. Brewer**, J. Liu, A.R. Wade, B.A. Wandell. Visual field maps and stimulus selectivity in human ventral occipital cortex. (2005). **Nature Neuroscience**. 8(8), 1102-9. doi:10.1038/nn1507.
5) S.M. Smirnakis, **A.A. Brewer**, M. Schmid, A.S. Tolias, M. Augath, W. Inhoffen, A. Shuz, B.A. Wandell, N.K. Logothetis, Lack of long-term cortical reorganization after macaque retinal lesions. (2005). **Nature**. 435(7040), 300-7. *News and Views* by M. I. Sereno (**Nature** 435, 288-289). doi:10.1038/nature03495.

B. Positions, Scientific Appointments, and Honors

POSITIONS AND EMPLOYMENT

1996 – 1997	Project Assistant, The Smith-Kettlewell Eye Research Institute, San Francisco, CA
1997 – 2001	Course Coordinator, Department of Biological Sciences, Stanford University
1998	Medical Scholar, Department of Vascular Surgery and Biomechanical Engineering, Stanford University School of Medicine
1998	Teaching Assistant – Gross Anatomy, Department of Surgery, Stanford University School of Medicine
1998 – 2001	The Honors Biology Writing Tutor, Department of Biological Sciences, Stanford University
1999	Research Assistant, Department of Neurology, Stanford University, and AGY Therapeutics
1999 – 2005	Research Assistant / Graduate Student, Neurosciences Program and Department of Psychology, Stanford University
2000 – 2001	Scientific Writing Tutor, Department of Biological Sciences, Stanford University
2002	Teaching Assistant, Department of Psychology, Stanford University
2005 – 2007	Postdoctoral Researcher, Department of Psychology, Stanford University
2007 – 2015	Assistant Professor, Department of Cognitive Sciences, University of California, Irvine
2015 – 2018	Vice Chair, Social and Behavioral Institutional Review Board (IRB) Committee ”C”, UCI
2015 – present	Associate Professor, Department of Cognitive Sciences, University of California, Irvine
2016 – present	Associate Professor, Department of Language Science, *by courtesy*, UCI
2019 – 2021	Vice Chair, Academic Senate Council for Planning and Budget
2021-2023	Chair, Academic Senate Council for Planning and Budget

OTHER SCIENTIFIC APPOINTMENTS AND MEMBERSHIPS

2001 – *intermit*	Member, Society for Neuroscience
2002 – *intermit*	Member, Vision Sciences Society
2008 – 2013	**Executive Committee Member**, Center for Cognitive Neuroscience & Engineering, University of California, Irvine
2008 – present	Annual Grant Reviewer, Alzheimer's Association
2009 – 2014	Member, Optical Society of America
2009 – 2010	**Elected Vice-Chair**, Vision Section, Optical Society of America
2010 – present	ad hoc reviewer, NSF Grant Peer Review Committee
2010 – 2013	**Elected Chair**, Vision Section, Fall Vision Meeting, Optical Society of America
2012 – present	**Editorial Board, Review Editor:** Frontiers in Psychology, Perception Science
2013 – present	Member, Center for Hearing Research, University of California, Irvine
2013 – present	**Standing Member**, **NSF** Grant Peer Review Panels (various: Cognition/Perception/EPSCoR/Major Instrumentation)
2014 – present	**Grant Reviewer Panelist:** Mechanisms of Sensory, Perceptual and Cognitive Processes (SPC); **Early Career Reviewer Program**, **NIH**
2015 – present	**Editorial Board, Review Editor:** Frontiers in Human Neuroscience
2015 – present	*Ad hoc* Grant Reviewer, international research panels: UK, Germany, Netherlands, Hong Kong, Austria, Israel
2020 –present	**Standing Member**, **NIH** Sensory and Motor Neuroscience, Cognition and Perception Fellowship Study Section [ZRG1 F02B-E]

HONORS AND AWARDS

1995	Biological Sciences Excellence in Teaching Award, Stanford University
1995	Howard Hughes Medical Institute Summer Fellowship, Stanford University
1996	Departmental Honors in the Biological Sciences, Stanford University
1996	Interdisciplinary Honors in the Humanities, Stanford University
1996	Biological Sciences Laura Weinstein Teaching Award and Grant (for the top undergraduate teaching assistant), Stanford University
1998	Resident Medical Scholars Grant – Gerbode Scholar, Stanford University
1998	Biological Sciences Excellence in Teaching Award, Stanford University
2002 – 2006	M.D. / Ph.D. pre-doctoral National Research Service Award (NRSA) Grant, National Institute of Neurological Disorders and Stroke, NIH
2002	First Place Poster: Stanford Medical Student Research Symposium
2006	American Medical Association (AMA) Seed Grant, Stanford School of Medicine
2008 – 2010	National Institutes of Health Loan Repayment Program Scholar
2010	2011-2012 Social Sciences Assistant Professor Research Award, UCI
2010 – 2012	National Institutes of Health Loan Repayment Program Scholar
2012	2009-2010 Social Sciences Assistant Professor Research Award, UCI
2012 – 2013	National Institutes of Health Loan Repayment Program Scholar
2014	2013-2014 Social Sciences Assistant Professor Research Award, UCI
2015	2014 – 2015 The Dean's Award for Outstanding Undergraduate Teaching, School of Social Sciences, UCI [*recognizes one outstanding undergraduate teacher]*
2018	"IntechOpen Women in Science 2018" Book Collection Initiative Winner
2020	Spring 2020 Outstanding Teaching Award – School of Social Sciences, UCI
2022	Honorable Mention, Dr. De Gallow Professor of the Year, UCI

C. **Contributions to Science**

1**. FUNDAMENTAL ORGANIZATION OF AUDITORY CORTEX:** In collaboration with Professors Greg Hickok (expertise: neuroimaging of speech & language) and Kourosh Saberi (expertise: psychoacoustics) at UCI, I have extended my expertise in visual field mapping measurements into examinations of human auditory cortex. Our measurements have revealed the first definitions of auditory cortical field maps (AFMs) arising from representations of tonotopic (frequency) and periodotopic (timing) inputs, with a similar organizational pattern of 'clover leaf' clusters across auditory cortex as I discovered in visual cortex. This set of experiments represents the start of the first systematic mapping of the cortical organization of speech perception from low-level acoustic features to higher-level speech and language (e.g., syllables). These studies are now expanding into investigations of 1) AFM organization throughout higher-order auditory and language-related cortical regions, 2) audiovisual integration across AFMs and VFMS, 3) periodotopic gradients throughout auditory cortex, and 4) the relationship of responses to speech and non-speech stimuli to these AFMs.

a) Barton, J.H. Venezia, K. Saberi, G. Hickok, **A.A. Brewer**. (2012) Orthogonal Acoustic Dimensions Define Auditory Field Maps in Human Cortex ***Proceedings of the National Academy of Sciences*** 109(50),20738-43

b) Barton, **A.A. Brewer**. (2015) Human Auditory Cortex. In ***Neurobiology of Language***, Eds. G. Hickok, S. Small. Elsevier. ISBN 978-0-12-407794-2. (Cambridge: Academic Press, Elsevier) Ch. 5, pp. 49-58

c) **A.A. Brewer**, B. Barton. (*in press*) Maps of the Auditory Cortex. ***Annual Review of Neuroscience***. 39(1)

d) **Add aud attention**

2**. FUNDAMENTAL ORGANIZATION OF VISUAL CORTEX:** This branch of research investigates the organization, function, and connectivity of human visual cortex using structural and functional MRI (fMRI) and diffusion tensor imaging (DTI). I have defined multiple visual field maps (VFMs) and uncovered a general organizing principle of visual and auditory cortex with VFMs organized into 'cloverleaf' clusters. This organization of visuospatial representations is important in understanding higher-order cognition, which relies upon the visuospatial knowledge gained from low-level visual processing. I further use these VFM and cluster definitions in completed and ongoing investigations of the functional properties and connectivity of particular VFMs. These include measurements of new VFMs involved in color, face, and/or object processing in occipital cortex. My work has expanded over the last decade to measurements of multisensory, attentional, and working memory measurements across cortex as well.

a) **A.A. Brewer**, W. A. Press, N. K. Logothetis, B. A. Wandell. (2002) Visual areas in macaque cortex measured using functional magnetic resonance imaging. ***Journal of Neuroscience.*** 22(23), 10416-10426

b) **A.A. Brewer**, J. Liu, A.R. Wade, B.A. Wandell. (2005) Visual field maps and stimulus selectivity in human ventral occipital cortex. ***Nature Neuroscience***. 8(8), 1102-9

c) B.A. Wandell, S.O. Dumoulin*, **A.A. Brewer***. [*Authors had equal contribution.] (2007) Visual Field Maps in Human Cortex. ***Neuron***. 56(2), 366-83

A.A. Brewer, B. Barton (2012) Visual field map organization in human visual cortex. In ***Visual Cortex- Current Status & Perspectives****,* Eds. S.Molotchnikoff, J.Rouat ISBN:978-953-51-0760-6 (Rijeka: InTech) Ch2, 30-60

3. PLASTICITY OF DEVELOPING VISUAL CORTEX: While it is clear that cortical representations in human are able to undergo significant reorganization during development (an early critical period of life), the extent of reorganization possible in the developing human brain is still not fully known. Over my career, I have been investigating a range of types of developmental problems and their impact on visual cortex. My graduate work demonstrated the first fMRI measurement of large-scale cortical reorganization in patients called rod monochromats, who are born with inactive cones. As a result, their cortex undergoes a large amount of reorganization in the region devoted to the fovea. I am also involved with a long-term collaboration following a now-famous patient who had his sight restored after 40 years of blindness. Such studies as these serve as a useful foundation for our measurements of plasticity in adult visual and auditory cortex.

a) H.A. Baseler, **A.A. Brewer**, L.T. Sharpe, A.B. Morland, H. Jägle, B.A. Wandell. (2002) Reorganization of human cortical maps caused by inherited photoreceptor abnormalities. ***Nature Neuroscience****.* 5(4), 364-70

b) Fine, A.R. Wade, **A.A. Brewer**, M.G. May, D.F. Goodman, G.M. Boynton, B.A. Wandell, D.I.A. MacLeod. (2003) Long-term deprivation affects visual perception and cortex. ***Nature Neuroscience.*** 6(9), 915-916

c) **A.A. Brewer**, B. Barton. (2014) Developmental Plasticity: FMRI Investigations into Human Visual Cortex. In ***Advanced Brain Neuroimaging Topics in Health and Disease - Methods and Applications***, Eds. T.D.Papageorgiou, G.Christopoulos, S.Smirnakis. ISBN: 978-953-51-1203-7. (Rijeka: InTech) Ch12, 305-334

d) Huber, J. Webster, **A.A. Brewer**, D. MacLeod, B. Wandell, A. Wade, I. Fine. (2015) A lack of experience-dependent plasticity after 12 years of recovered sight. ***Psychological Science****.* 26(4), 393-401

4. PLASTICITY OF NORMAL ADULT SENSORY CORTEX: The holy grail of many fields of brain research is to harness the adult cortex's ability to reorganize. An understanding of how to induce plasticity in the adult cortex could foster the development of treatments of such devastating conditions as paralysis, neurodegenerative disease and stroke. Such conditions typically result in a *loss* of sensory input, causing many researchers to focus almost exclusively on that. However, it is also imperative to study the brain's response to *changes* of sensory input, because *changing* sensory input is the only way that we will be able to harness the brain's inherent plasticity to overcome the *loss* of sensory input. I have been using MRI, fMRI and DTI to investigate plasticity in visual cortex as a result of *removing* and *changing* visual input in adults. Work I completed during graduate school showed that limited cortical reorganization occurs in adult primate in response to retinal vision loss. In contrast, recent work as a professor at UCI revealed that prolonged adaptation in healthy, adult humans to an extreme change of visual input (via left-right reversing prism goggles) can produce sustained functional plasticity in parietal cortex. I have also used the removal of visual input under scotopic vision, which produces a reversible scotoma in the central fovea, to 1) show that short-term population receptive field (pRF) dynamics at the edge of a scotoma resemble claims made in several studies of long-term plasticity and 2) to tie perception to cortical activity through perceptual filling-in. Finally, I have been complementing my neuroimaging measurements with studies of behavioral genetics to investigate questions regarding the role of neurotrophic factors in visuomotor adaptation. Our first study utilizes polymorphisms in brain-derived neurotrophic factor (BDNF), the most abundant neurotrophin in the brain. BDNF is widely expressed in cortex and influences a broad range of brain events related to developmental neuronal differentiation, synaptic plasticity, and neuronal survival in adulthood. We have examined the effects of a genetic polymorphism of the neurotrophic factor BDNF on visuomotor adaptation and find a paradoxical role of BDNF in the interplay of cortical plasticity and stability that underlies behavioral learning, with broader implications for the effects of genetic differences on adult cortical recovery and repair. The next step is to expand these measurements to other sensory systems.

a) S.M. Smirnakis, **A.A. Brewer***, M. Schmid*, A.S. Tolias, M. Augath, W. Inhoffen, A. Shuz, B.A. Wandell, N.K. Logothetis, [*Authors had equal contribution]. (2005) Lack of long-term cortical reorganization after macaque retinal lesions. ***Nature***. 435(7040), 300-7

b) B. Barton, A. Treister, M. Humphrey, G. Abedi, S.C. Cramer, **A.A. Brewer**. (2014) Paradoxical Visuomotor Adaptation to Reversed Visual Input Predicted by BDNF Val^{66}Met Polymorphism ***Journal of Vision*** 14(19):4

c) Barton, **A.A. Brewer**. (2015) FMRI of the Rod Scotoma: Cortical rod pathways and implications for lesion measurements. ***Proceedings of the National Academy of Sciences (PNAS) USA***. 112(16), 5201-5206

d) '**Messing with Reality?**' - Episode 1 of The Brain with David Eagleman - Exploration Into the Inner Cosmos. (Filmed 8/23/2014; Aired 10/15/2015). ***Publisher: PBS***, produced by Blink Films. http://www.pbs.org/the-brain-with-david-eagleman/home/. Part 1: Alyssa A. Brewer, M.D., Ph.D.; host: David Eagleman, Ph.D.

5. CORTICAL PLASTICITY IN PATIENTS WITH CORTICAL DAMAGE: The use of VFM and pRF measurements to track changes in cortex can also be applied to translational clinical studies. In ongoing investigations, I am using neuroimaging measurements of human visual cortex to examine whether there is a systematic change in visual cortex as part of the pathophysiology of neurodegenerative disorders such as Alzheimer's disease, Dementia with Lewy Bodies, and Posterior Cortical Atrophy. Supported by a pilot grant from UCI's MIND Institute, these studies explore how these *in vivo* visual measurements may be used to improve early detection and accurate diagnosis of dementia and complement measurements of the normal aging process in visual cortex. In collaboration with Dr. Steven Cramer at UCI, I am similarly using measurements of VFMs and pRFs in a study of the potential for rehabilitation of damaged human visual cortex in stroke patients. We recently received a pilot grant from UCI's Institute of Clinical and Translational Sciences for our proposal to refine these methods to enhance our ability to track cortical recovery through visual training.

a) **A.A. Brewer**. (2009) Visual Maps: To merge or not to merge. ***Current Biology***. 19(20):R945-7

b) **A.A. Brewer**, B. Barton. (2012) Effects of healthy aging on human primary visual cortex. ***Health*** 4(9A) 695-702

c) **A.A. Brewer**, B. Barton. (2014) Visual cortex in aging and Alzheimer's disease: Changes in visual field maps and population receptive fields. *Research Topic: Visual perception and visual cognition in healthy and pathological ageing*. ***Frontiers in Psychology, Perception Science***. 5(74)

COMPLETE LIST OF PUBLISHED WORK IN MYBIBLIOGRAPHY:
https://www.ncbi.nlm.nih.gov/myncbi/alyssa.brewer.1/bibliography/public/