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PROFESSIONAL EXPERIENCE

1991:	Intramural Research Training Assistant National Inst. of Environmental Health Science, Research Triangle Park, NC:
1993-1994:	Graduate Research Assistant UNC School of Nursing, Chapel Hill, NC
1994 - 1995:	Graduate Research Assistant UNC Magnetic Resonance Imaging facility, Chapel Hill, NC
1995 - 1997:	Graduate Research Assistant Nathan Kline Institute, Orangeburg, NY
1997 - 1999:	Research Fellow Department of Neurosurgery, Wake Forest University Medical School, Winston-Salem, NC
1999 - 2006:	Assistant Research Scientist FMRI Laboratory and Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI
2006-2016:	Associate Research Professor FMRI Laboratory and Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI
2014-2021:	Co-Director University of Michigan's Engineering Preclinical Imaging Center
2016-2022:	Research Professor FMRI Laboratory and Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI
2022-present:	Research Professor Radiology department, University of Michigan, Ann Arbor, MI

EDUCATION

1988-1992:	B.S. in Applied Science. University of North Carolina, Chapel Hill, NC
1992-1994:	M.S. in Biomedical Engineering. University of North Carolina, Chapel Hill, NC
1994-1998:	Ph.D.in Biomedical Engineering under the supervision of Dr. Craig A. Branch, Doctoral Dissertation: " Validity of the Steady Sate Model for Arterial Spin Tagging Cerebral Perfusion Measurements". University of North Carolina, Chapel Hill , NC

HONORS and AWARDS

1988–1992:	Dean's List.
1991:	Intramural Research Training Assistantship at the National Institute of Environmental Health Science, RTP, NC.

1992:	James Crawford Award in the Applied Sciences.
1995:	Magnex Scientific Graduate Fellowship in Medical Physics.
1997-1998:	International Society for Magnetic Resonance in Medicine Student Travel Stipend
1998:	University of North Carolina at Chapel Hill: Student Travel Award, April 1998

PROFESSIONAL AFFILIATIONS

Biomedical Engineering Society.
International Society of Magnetic Resonance in Medicine.
Organization for Human Brain Mapping.

PROFESSIONAL ACTIVITIES

Created and taught course at University of Michigan: “Special Topics in FMRI” (2003)

Co-organized the Bi-weekly Functional Neuroimaging seminar, University of Michigan: (2000-2005)

Organized the Midwest Regional Fall symposium on MRI, Ann Arbor, Michigan, (2007)

Advisor, Biomedical Engineering Society, UM student chapter, (2000 – 2008)

Academic Advisor, Biomedical Imaging track, Biomedical Engineering Department, University of Michigan, (2000 – present)

Admissions Committee for University of Michigan’s summer FMRI course, (2005-present)

Created and Distributed ORTHO and F-ASL (Matlab libraries for visualization, ROI time series analysis, Granger Causality analysis, Arterial Spin Labeling FMRI analysis, 2002-present

Advisory Board Member for Pediatric Functional Neuroimaging Research Network (NIH contract – RFP No. NIH-NICHD-CRMC-09-20, PI: Scott Holland) - Cincinnati Children’s Hospital (2009-present)

Co-organized the Monthly Transcranial Magnetic Stimulation Working group, University of Michigan: (2011-2013)

University of Michigan FMRI Laboratory Operations Committee (2000-2011)

University of Michigan FMRI Laboratory Advisory Executive Committee (2011 – present)

Advisory Board member for Advances in Neuropsychiatric Treatment Conference, San Francisco, CA, (2012)

University of Michigan FMRI Laboratory Strategic Planning Committee (2012 – present)

Co-director of UM Biomedical Engineering High Field MRI facility (2014 – present)

UM College of Engineering curriculum committee (2016- 2017)

BME directed research matching program (2016- present)

FMRI Laboratory Safety coordinator (2017- present)

UM Laboratory and Research Safety Committee (LRSC) – (2017-2019)

FMRI Laboratory Animal research director (2017- 2022)

Organized University of Michigan International workshop on Arterial Spin Labeling (March 2019)

Organized, coordinated and co-authored a series of consensus and review paper, nicknamed the **“ASL grey papers”** in the journal Magnetic Resonance in Medicine and with the endorsement of the ISMRM Perfusion Study group (2020-2023).

International Society for Magnetic Resonance in Medicine: Perfusion Study Group Secretary (2022-2023)

International Society for Magnetic Resonance in Medicine: Perfusion Study Group vice-chair (2023-2024)

Organizing Committee of ISMRM workshop on “MRI of Neuromodulation: Target Engagement, Neural Mechanism & Biomarker Development” (2022)

UM BME department: graduate education committee (GEC), (2022-2023)
Member of Open Source Initiative for Perfusion Imaging (OSIPI) and lead of educational task force (2023-2025)
Co-chair of Organizing Committee of ISMRM workshop on “Perfusion MRI: Found in Translation” (2025)

JOURNAL REVIEWING

Magnetic Resonance in Medicine (2004-)

Neuroimage (2008 -)

IEEE- Transactions in Biomedical Engineering (2010-)

NMR in Biomedicine (2004 -)

Magnetic Resonance Imaging (2006 -)

Human Brain Mapping (2006 -)

Biological Psychiatry (2008-)

Biomedical Signal Processing and Control (2012-)

Journal of Magnetic Resonance Imaging (2012-)

American Journal of Neuroradiology (2014 -)

Journal of Pain (2014-)

Journal of Cerebral Blood Flow and Metabolism (2015 -)

Medical Physics (2014-)

Neuropsychopharmacology (2018-)

IEEE – Transactions in Medical Imaging (2021 -)

Nature Communitcations (2020-)

GRANT REVIEWING

National Institute on Drug Abuse (NIDA) Imaging – Science Track Award for Research Transition (I/START) program (2008)

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) ad hoc review panel (2009)

National Institutes of Health Emerging Technologies and Training in Neurosciences IRG - Challenge grants (2009)

National Science Foundation, Cognitive Neuroscience Section, Major Research Instrumentation (MRI) ad hoc review panel (2010).

Cognitive Neuroscience Program at the National Science Foundation (2008)

National Institutes of Health, Small Business Grants: Clinical Neurophysiology, Devices, Auditory Devices and Neuroprosthesis (2011)

American Association for the Advancement of Science (AAAS), reviewer for Saudi Arabian government’s scientific funding agency “King Abdulaziz City for Science and Technology (KACST)” (2011)

National Institutes of Health, Biomedical Imaging and Technology (BMIT-B) study section ad hoc reviewer (2013)

National Institutes of Health, Biomedical Imaging and Technology (BMIT-B) study section charter member (2014-18)

National Science Foundation, Experimental Program to Stimulate Competitive Research (EPSCoR) (2015)

Canada Foundation for Innovation, John R. Evans Leaders Fund (2019)

National Institutes of Health, Emerging Imaging Technology (EITN) study section ad hoc reviewer (2020-21).

National Institutes of Health, Emerging Imaging Technology (EITN) study section charter member (2021-2025).

PEER REVIEWED PUBLICATIONS

1. Kadiiska MGB, Hanna PM, **Hernandez** L, Mason RP: In vivo evidence of Hydroxyl Radical Formation after Acute Copper and Ascorbic Acid Intake: Electron Spin Resonance - Spin Trapping Investigation. *Mol. Pharmacology*, 42 (2): 723-729, 1993.
2. **Hernandez** L, Waag BJ, Hsiao HS, Neelon, VM: Development of a New Non-Invasive Monitoring System for Sleeping Subjects. *Physiological Measurement, 16,* 161-167, 1995.
3. Branch CA, **Hernandez** L, Yongbi M, Helpern JA: Rapid and Continuous Monitoring of Cerebral Perfusion by MRI Arterial Spin Tagging with Line Scan Assessment, *NMR in Biomedicine* 11, 1-11, 1998.
4. Bastings EP, Gage HD, Greenberg JP, Hammond G, **Hernandez** L, Hamilton CA, Moody DM, Singh KD, Ricci PE, Pons TP, Good DC: Co-registration of Cortical Magnetic Stimulation and Functional Magnetic Resonance Imaging. *Neuroreport 9,* 1941-1946, 1998. PMID: 9674571
5. EP Bastings, Y-F Yen, GL Hammond, JH Burdette, HD Gage, JP Greenberg, DM Moody, L **Hernandez**, DC Good, S Mc Dermott, TP Pons. Serial co-registration of fMRI and TMS mapping during motor recovery after stroke. *Stroke 2000;* 31:290
6. Weaver KD, Branch CA, **Hernandez** L, Claramae HM, Quattrocci KB: Effect of Leukocyte-Endothelial Adhesion Antagonism on Neutrophil Migration and Neurologic Outcome after Cortical Trauma. *The Journal of Trauma, vol 48, n. 6, pp.* 1081 -1090, 2000
7. **Hernandez** L, Badre DT, Noll DN, Jonides J: Temporal Sensitivity of Event Related fMRI. *Neuroimage, 17,* 2,p.1018-1026 , 2002.
8. Sylvester CY, Wager TD, Lacey SC, Jonides J, Smith EE, **Hernandez** L, Nichols TE : Switching Attention and Resolving Interference: fMRI Measures of Executive Functions. *Neuropsychologia, 41*, 357-370
9. **Hernandez-Garcia** L, Lee GR , Vazquez AL, Noll DC: Fast, Pseudo-Continuous Arterial Spin Labeling for Functional Imaging Using a Two-Coil System, *Magnetic Resonance in Medicine* ,51,3,p.577-585, 2004, PMID: 15004800
10. Wager TD, Vazquez AL, **Hernandez-Garcia** L, Noll DC: Accounting for Nonlinear BOLD Effects in fMRI: Parameter Estimates and a Model for Prediction in Rapid Event-related Studies, *Neuroimage 2005* Mar; 25 (1) :206-18. PMID: 15734356
11. **Hernandez-Garcia L**, Lee GR , Vazquez AL, Noll DC: Quantification of Perfusion FMRI using a numerical model of Arterial Spin Labeling accounting for dynamic transit time effects. *Magnetic Resonance in Medicine, 54, 4, 955-954, 2005.* PMID: 16155868
12. Vazquez AL, Lee GR, **Hernadez-Garcia** L, Noll DC: Application of selective saturation to image the dynamics of arterial blood flow during brain activation using magnetic resonance imaging, *Magnetic Resonance in Medicine, 55, 4, 816-825, 2006,* PMID: 16506156
13. Mumford JA, **Hernandez-Garcia L**, Lee GR, Nichols TE: Estimation Efficiency and Statistical Power in Arterial Spin Labeling FMRI. *Neuroimage, 33 (1), 103-114, 2006*, NIHMS144610, PMID: 16860577
14. Vazquez AL, Cohen ER, Gulani V, **Hernandez-Garcia L**, Zheng Y, Lee GR, Kim SG, Grotberg JB, Noll DC: Vascular Dynamics and BOLD fMRI: CBF Level Effects and Analysis Considerations. *Neuroimag*e, 32 (4), 1642-1655, 2006. PMID: 16860574.
15. Lee GR, **Hernandez-Garcia L**, Noll DC: Functional Imaging With Turbo-CASL: Transit Time and Multislice Imaging Considerations. *Magnetic Resonance in Medicine*, 57(4), 661-669, 2007. PMID: 17390351

16. **Hernandez-Garcia, L**., Lee, S., & Grissom, W. (2007). An approach to MRI-based dosimetry for transcranial magnetic stimulation. *Neuroimage*, 36(4), 1171-1178. PMID: 17509897
17. **Hernandez-Garcia, L**., Lewis, D. P., Moffat, B., & Branch, C. A. (2007). Magnetization transfer effects on the efficiency of flow-driven adiabatic fast passage inversion of arterial blood. *NMR Biomed*, 20(8), 733-742. NIHMS144609, PMID: 17304639
18. Chowdhry P, Demeter EM, **Hernandez-Garcia L**: Optimizing CompCor in a cognitive ASL-FMRI experiment: A Sustained Attention Task. NeuroImage, Volume 47, Supplement 1, July 2009, Pages S59
19. **Hernandez-Garcia L,** Vazquez AL, Rowe DB: Complex analysis of arterial spin labeling based FMRI signals, *Magnetic Resonance in Medicine*, 62(6), 1597-1608, 2009. NIHMS144607. PMID: 19859934
20. Tran, TD, Heng W, Tandon, A, **Hernandez-Garcia, L,** Casey, KL: Evidence supporting a thalamocortical modulation of the temporal summation of heat pain in humans, *Pain*, Jul;150(1):93-102, 2010.
21. **Hernandez-Garcia L**, Jahanian H, Rowe DB: Quantitative Analysis of Arterial Spin Labeling FMRI Data Using a General Linear Model. Magnetic Resonance Imaging, 28 (7), Pages 919-927, 2010. [PMID: 20456889]
22. **Hernandez-Garcia L**, Hall TL, Gomez L, Michielssen E: A numerically optimized active shield for improved TMS targeting, *Brain Stimulation*, 2010 Oct;3(4):218-25. PMID: 20965451. [NIHMS 210101]
23. Jahanian H, Noll DC, **Hernandez-Garcia L**: B(0) field inhomogeneity considerations in pseudo-continuous arterial spin labeling (pCASL): effects on tagging efficiency and correction strategy2011 , 65: 1570-1577; doi: 10.1002/mrm.22922. PMID 21446035.
24. **Hernandez-Garcia L**, Ulfarsson MO: Neuronal Event Detection in FMRI Time Series Using Iterative Deconvolution Techniques. *Magnetic Resonance Imaging*, 2011 Apr;29(3):353-64.. PMID: 21232893
25. Demeter E, **Hernandez-Garcia L**, Sarter M: Top-down control of attention: a continuous arterial spin labeling (ASL) study of the effects of distraction on sustained attention. *Neuroimage*, 2011 Jan 15;54(2):1518-29. PMID: 20851189
26. **Hernandez-Garcia L**, Jahanian H, Greenwald M, Zubieta JK, Peltier SJ: Real-Time Functional MRI Using Pseudo-Continuous Arterial Spin Labeling, *Magnetic Resonance in Medicine*, 2011 , 65: 1570-1577; doi: 10.1002/mrm.22922. PMID 21446035.
27. Demiralp E, Demiralp M, **Hernandez-Garcia L**: A Probabilistic Foundation for Dynamical Systems: Phenomenological Reasoning and Principal Characteristics of Probabilistic Evolution. J. Mathematical Chemistry, 2011, 1-11, doi:10.1007/s10910-011-9930-4.
28. Demiralp E, Demiralp M, **Hernandez-Garcia L** A Probabilistic Foundation for Dynamical Systems: Theoretical Background and Mathematical Formulation. J. Mathematical Chemistry 2012, vol. 50, n.4, pp. 850-869
29. Nielsen JF, **Hernandez-Garcia L**, Functional perfusion imaging using pseudocontinuous arterial spin labeling with low-flip-angle segmented 3D spiral readouts. Magnetic Resonance in Medicine 69, 382 (Apr 4, 2012).
30. Demiralp E, Jaeggi S, Buschkuehl M, Matta J, Thompson RJ, **Hernandez-Garcia L**, Feldman Barrett L, Ellsworth PC, Gotlib IH: Jonides J: Feeling Blue or Turquoise? Emotional Differentiation in Major Depressive Disorder. Psychological Science (2012), 23 (11); 1410-1416. (DOI: 0.1177 / 0956797612444903)
31. **Hernandez-Garcia L**, Buschkuehl M: Advances in Longitudinal fMRI diagnostic tests, Expert Opinion on Medical Diagnostics, (DOI:10.1517/17530059.2012.686995).
32. Schmithorst V , **Hernandez-Garcia L** , Vannest J, Rajagopal A, Lee G, Holland SK: Optimized Simultaneous ASL and BOLD Functional Imaging of the Whole Brain, Journal of Magnetic Resonance Imaging, (2013). doi: 10.1002/jmri.24273..

33. Gomez L, Cajko F, **Hernandez-Garcia L**, Grbic L, Michielssen E: Numerical Analysis and Design of Single-Source Multi-Coil TMS for Deep and Focused Brain Stimulation, IEEE Transactions in Biomedical Engineering, 2013, 60(10), 2771-2782. PMID: 23708768

34. **Hernandez-Garcia L**, Bhatia VR, Prem Kumar K, Ulfarsson M: Magnetic Resonance Imaging of time-varying magnetic fields from therapeutic devices, NMR in Biomedicine, 2013, 26(6), 718-724 (PMID: 23355446, NIHMS443960 , DOI: 10.1002/nbm.2919)

35. Jahanian H, Peltier SJ, Noll DC, **Hernandez-Garcia L**: "Arterial cerebral blood volume–weighted functional MRI using pseudocontinuous arterial spin tagging (AVAST)," Magn. Reson. Med., 73: 1053-1062, (2015). (DOI:10.1002/mrm.25220)

36. Allen SP, Hall TL, Cain CA , **Hernandez-Garcia L**: Controlling Cavitation-Based Image Contrast in Focused Ultrasound Histotripsy Surgery. Magn Reson Med. 2015, 73: 204-213. doi: 10.1002/mrm.25115

37. Alsop DC, Detre JA, Golay X, Günther M, Hendrikse J, **Hernandez-Garcia L**, Lu H, MacIntosh BJ, Parkes LM, Smits M, van Osch MJP, Wang JJ, Wong EC, Zaharchuk G: Recommended Implementation of Arterial Spin Labeled Perfusion MRI for Clinical Applications: A consensus of the ISMRM Perfusion Study Group and the European Consortium for ASL in Dementia, Mag. Res. Med., 73, p. 102-106 (2015), DOI 10.1002/mrm.25197

38. Buschkuehl, M., **Hernandez-Garcia, L**., Jaeggi, S. M., Bernard, J. A., & Jonides, J. (2014). Neural effects of short-term training on working memory. Cognitive, Affective & Behavioral Neuroscience. doi:10.3758/s13415-013-0244-9

39. Schmithorst, V. J., Vannest, J., Lee, G., **Hernandez-Garcia, L**., Plante, E., Rajagopal, A., & Holland, S. K. (2015). Evidence that neurovascular coupling underlying the BOLD effect increases with age during childhood. Human brain mapping, 36(1), 1-15.

40. Gomez, L. J., Yucel, A. C., **Hernandez-Garcia, L.,** Taylor, S. F., & Michielssen, E. (2015). Uncertainty quantification in transcranial magnetic stimulation via high-dimensional model representation. Biomedical Engineering, IEEE Transactions on, 62(1), 361-372.

41. Allen, S, **Hernandez-Garcia, L,** Cain, C, Hall T: MR-Based Detection of individual Histotripsy Bubble Clouds Formed in Tissues and Phantoms. Magnetic Resonance in Medicine. 76: 1486–1493, (2016)

42. Shah YS, **Hernandez-Garcia L,** Jahanian H, Peltier SJ, "Support vector machine classification of Arterial Volume-weighted Arterial Spin Tagging (AVAST) images", Brain and Behavior, 6, 1-8 (2016).

43. Allen, S; Vlaisavljevich, E; Shi, J**; Hernandez-Garcia, L**; Cain, Charles; Xu, Zhen; Hall, Timothy: "The Response of MRI Contrast Parameters in In Vitro Tissues and Tissue Mimicking Phantoms to Fractionation by Histotripsy". Physics in Medicine and Biology. (2017), v.62, n. 17, p. 7167-7180

44. **Hernandez-Garcia L**, Lahiri A, Schollenberger J. NeuroImage Recent progress in ASL. Neuroimage 2018:1–14. doi: 10.1016/j.neuroimage.2017.12.095.

45. Wright, K. L., Jiang, Y., Ma, D., Noll, D. C., Griswold, M. A., Gulani, V., & **Hernandez-Garcia, L.** (2018). Estimation of perfusion properties with MR Fingerprinting Arterial Spin Labeling. Magnetic resonance imaging, 50, 68-77.

46. **Hernandez-Garcia, L**, Nielsen, JF, Noll, DC: Improved sensitivity and temporal resolution in perfusion FMRI using velocity selective inversion ASL. (2018) Magnetic Resonance in Medicine, 00, 1-12. https://doi.org/10.1002/mrm.27461

47. Taylor, S. F., Ho, S. S., Abagis, T., Angstadt, M., Maixner, D. F., Welsh, R. C., & **Hernandez-Garcia, L.** (2018). Changes in brain connectivity during a sham-controlled, transcranial magnetic stimulation trial for depression. Journal of affective disorders, 232, 143-151.

48. Fan J, Tso IF, Maixner DF, Abagis T, **Hernandez-Garcia** L, Taylor SF. Segregation of salience network predicts treatment response of depression to repetitive transcranial magnetic stimulation. NeuroImage Clin. 2019;22:101719. doi: 10.1016/J.NICL.2019.101719.

49. Schollenberger, J, Figueroa, CA, Nielsen, J-F, **Hernandez-Garcia, L**. Practical considerations for territorial perfusion mapping in the cerebral circulation using super-selective pseudo-continuous arterial spin labeling. Magn Reson Med. 2019; 8(2): 1– 13. https://doi.org/10.1002/mrm.27936
50. Lahiri A, Fessler JA, **Hernandez-Garcia L**. Optimizing MRF-ASL scan design for precise quantification of brain hemodynamics using neural network regression. Magn Reson Med. 2019;(May 2019):1979-1991. doi:10.1002/mrm.28051
51. Clement P, Castellaro M, Okell T, Thomas D, Gorgolewski C, Appelhoff S, Petr J, Chappell M, Mutsaerts H-J , et al.. ASL-BIDS, the brain imaging data structure extension for arterial spin labeling. Magn. Reson. Mater. Physics, Biol. Med. 2019;32:S147--8. doi: 10.1007/s10334-019-00754-2.
52. Taylor SF, Lee TG, Jonides J, Tso IF, **Hernandez-Garcia L.** Theta Burst Transcranial Magnetic Stimulation of Fronto-Parietal Networks: Modulation by Mental State . J Psychiatry Brain Sci. 2020;5(3):e200011. doi:10.20900/jpbs.20200011
53. Guo J , Das S, and Hernandez-Garcia L. "Comparison of Velocity-Selective Arterial Spin Labeling Schemes." Magnetic Resonance in Medicine, 2020, 85(4), 2027-2039. doi:10.1002/mrm.28572.
54. Schollenberger, J., Harold Osborne, N., **Hernandez-Garcia, L**. & Figueroa, C. A. "A Combined Computational Fluid Dynamics and Arterial Spin Labeling MRI Modeling Strategy to Quantify Patient-Specific Cerebral Hemodynamics in Cerebrovascular Occlusive Disease". Front. Bioeng. Biotechnol. 9, 689 (2021).
55. Clement, Patricia, Petr, Jan, Dijsselhof, Mathijs B J, Padrela, Beatriz, Pasternak, Maurice, Dolui, Sudipto, Jarutyte, Lina, Pinter, Nandor, **Hernandez-Garcia, Luis**, Jahn, Andrew, Keil, Vera CA : Beginner's Guide to Arterial Spin Labeling (ASL) Image Processing. Front. Radiol. 2022;2:19. doi: 10.3389/fradi.2022.929533.
56. Qin, Qin, Alsop, David C., Bolar, Divya S., **Hernandez-Garcia, Luis**, Liu, Dapeng, Meakin, James A, Nayak, Krishna S., Schmid, Sophie, van Osch, Matthias J.P., Woods, Joseph G.,Wong, Eric C., Zhao, Moss Y., Zaharchuk, Greg, Zun, Zungho, Guo, Jia, on behalf of the ISMRM Perfusion StudyGroup, Velocity-selective arterial spin labeling perfusion MRI : A review of the state of the art and recommendations for clinical implementation. Magn. Reson. Med. 2022:1–20. doi: 10.1002/mrm.29371.
57. **Luis Hernandez-Garcia**, Veronica Aramendia-Vidaurreta, Divya S. Bolar, Weiying Dai, Maria A. Fernández-Seara, Jia Guo, Ananth J. Madhuranthakam, Henk Mutsaerts, Jan Petr, Qin Qin, Jonas Schollenberger, Yuriko Suzuki, Manuel Taso, David L. Thomas, Matthias J. P. van Osch, Joseph Woods, Lirong Yan, Ze Wang, Li Zhao, Moss Y. Zhao, Thomas W. Okell: "Recent Technical Developments in ASL: A Review of the State of the Art." Magnetic Resonance in Medicine 2022. Vol 88,(5), p 2021-2042, doi: 10.1002/mrm.29381.
58. Lee,S, Meyer BP, **Luis Hernandez-Garcia, L**, Kurpad, SN, Schmit, BD, Budde, MD: Comparison and optimization of pCASL and VSASL for Rat Thoracic Spinal Cord MRI at 9.4T, Mag. Res. Med., 2023,p 1-13. doi:10.1002/mrm.29603
59. Taylor, S., Gu, P., Simmonite, M., Lasagna, C., Tso, I., Lee, T., Vesia, M. and **Hernandez-Garcia, L.** "Lateral prefrontal stimulation of active cortex with theta burst transcranial magnetic stimulation affects subsequent engagement of the frontoparietal network." Biological Psychiatry: Cognitive Neuroscience and Neuroimaging (2023).
60. Schollenberger, Jonas, Drew J. Braet, **Luis Hernandez-Garcia**, Nicholas H. Osborne, and C. Alberto Figueroa. "A magnetic resonance imaging-based computational analysis of cerebral hemodynamics in patients with carotid artery stenosis." *Quantitative Imaging in Medicine and Surgery* 13, no. 2 (2023): 1126.
61. Hong T, **Hernandez-Garcia L**, Fessler JA (2024) A Complex Quasi-Newton Proximal Method for Image Reconstruction in Compressed Sensing MRI. IEEE Trans Comput Imaging 10:372–384. https://doi.org/10.1109/TCI.2024.3369404
62. Woods, JG, Achten, E, Asllani, I, Bolar, DS, Dai, W, Detre, JA, Fan, AP, Fernández-Seara, M, Golay, X, Günther, M, Guo J, **Hernandez-Garcia L**, Ho ML, Juttukonda MR, Lu H, MacIntosh

BJ, Madhuranthakam A, Mutsaerts HJ, Okell TW, Parkes LM, Pinter N6, Pinto J, Qin Q, Smits M, Suzuki Y, Thomas DL, Van Osch MJP, Wang DJJ, Warnert, EAH, Zaharchuk G, Zelaya F, Zhao M, Chappell MA: Recommendations for Quantitative Cerebral Perfusion MRI using Multi-Timepoint Arterial Spin Labeling: Acquisition, Quantification, and Clinical Applications, Magn. Res. Med (2024).

63. Qin, Qin, David C. Alsop, Divya S. Bolar, **Luis Hernandez-Garcia**, James Meakin, Dapeng Liu, Krishna S. Nayak et al. "Erratum to: Velocity-selective arterial spin labeling perfusion MRI: A review of the state of the art and recommendations for clinical implementation (Magn Reson Med. 2022; 88: 1528-1547)." *Magnetic resonance in medicine* (2024).

EDUCATIONAL VIDEOS

1. Hernandez-Garcia L, Frey D, Jahn A: The Physics of Arterial Spin Labeling. (playlist at YOUTUBE https://www.youtube.com/playlist?list=PLTIlnXdb9rwhoO8afyba3GQSh8ueShJ03)

INVITED BOOK CHAPTERS AND ARTICLES

1. **Hernandez** L, Wager TD, Jonides J: "Introduction to Functional Brain Imaging" in Stevens' *Handbook of Experimental Psychology, Third Edition. Volume 4: Methodology in Experimental Psychology*. Edited by John Wixted and Hal Pashler, John Wiley and Sons, Inc New York, NY, 2002.
2. Wager TD, **Hernandez-Garcia L**, Jonides J: "Elements of Functional Neuroimaging", in Cacioppo, J. T., Tassinary, L. G., & Berntson, G. G: *Handbook of psychophysiology (3rd ed ed.).* New York: Cambridge University Press.(2007)
3. **Hernandez-Garcia L**, Peltier SJ, Grissom W: "FMRI Hardware" in M. Filippi (ed.): *fMRI Techniques and Protocols*, Neuromethods, vol 41, Humana Press, 2009.
4. **Hernandez-Garcia L**, Jahanian H: "Perfusion Based Functional MRI" in *Functional Magnetic Resonance Imaging / Book 1* , edited by Papageorgiou TD, Christopoulos G, Smirnakis S, InTech Open Access Publisher,. ISBN 979-953-307-775-7. 2014
5. **Hernandez-Garcia L,** Muckley M: "fMRI Artifacts and their Correction" in *Brain Mapping: An Encyclopedic Reference* edited by A. Toga., Elsevier Pubublishing, Oxford, UK, *2015*
6. **Hernandez-Garcia, L.,** Peltier, S., & Grissom, W. (2016). Introduction to Functional MRI Hardware. In fMRI Techniques and Protocols (pp. 29-67). Humana Press, New York, NY.
7. **Hernandez-Garcia L**, Lahiri A, Schollenberger J. NeuroImage Recent progress in ASL. Neuroimage 2018:1–14. doi: 10.1016/j.neuroimage.2017.12.095.

INVITED LECTURES

1) **Hernandez-Garcia, L** : "The Long Road toward Perfusion based fMRI". University of Michigan Symposium on functional MRI, September 2002.
2) **Hernandez-Garcia L**, Granovsky Y, Wang H, Casey K: "Thalamic and Cortical Responses during Pain: Time Series Analysis". University of Michigan Symposium on functional MRI, September 2003.
3) **Hernandez-Garcia L**: "Arterial Spin Labeling for Quantitative Functional MRI". Proceedings of the IEEE-EMBS meeting, San Francisco, CA, 2004
4) **Hernandez-Garcia L** : "Fast, Quantitative, Arterial Spin Labeling for functional MRI". Invited lecture at Purdue University's Biomedical Engineering Department seminar. November 2005.

5) **Hernandez-Garcia L** : "Footprints of Causality". University of Michigan Symposium on functional MRI, September 2006.

6) **Hernandez-Garcia L** : "The Footprints of Causality in FMRI Data". Duke University Brain Imaging and Analysis Center Seminar, March 2007.

7) **Hernandez-Garcia, L**: "Fast, Quantitative, Arterial Spin Labeling for functional MRI". Invited lecture at Oakland University's Physics Department seminar. November 2007.

8) **Hernandez-Garcia, L**: "Some interesting Topics in Non-invasive Human Brain Research". Invited lecture at University of Michigan's BMES, Feb. 2008.

9) **Hernandez-Garcia, L:** "Arterial Spin Labeling for FMRI: principles and current topics", Cincinatti Children's Hospital Medical Center, Radiology Department, Jan. 2010.

10) **Hernandez-Garcia, L:** "Arterial Spin Labeling for FMRI: principles and current topics", Invited Lecture at Laboratorio de Analisis de Imagen Medica y Bioingenieria , Universidad Rey Juan Carlos, Madrid, Spain, Jun. 2010.

11) **Hernandez-Garcia, L**: "Overcoming the degradation of ASL by off-resonance effects". Invited lecture at University of Pittsburgh's Radiology Department, June 2010.

12) **Hernandez-Garcia, L**: "Longitudinal FMRI in Neuropsychiatric disorders using Arterial Spin Labeling", Advances in Neuropsychiatric Treatment Conference, San Francisco, CA, Sept. 22-23, 2011

13) **Hernandez-Garcia, L**: "Longitudinal FMRI using Arterial Spin Labeling", guest lecture at Albert Einstein College of Medicine's MRRC. Oct. 24, 2011.

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17) **Hernandez-Garcia L:** "ASL Acquisition Methods". ISMRM annual meeting 2019, Montreal, QC, Canada. Basic Perfusion Educational Course.

18) **Hernandez-Garcia L:** "Quantitative hemodynamic imaging using velocity selective ASL fingerprinting and neural nets". Imaging Cerebral Physiology webinar. School of Life Sciences, The University of Nottingham Medical School, Nottingham, United Kingdom. Jan 27, 2022

19) **Hernandez-Garcia L** : "Recent technical developments in ASL: A Review of the State of the Art", ISMRM Perfusion Study Group workshop , "Perfusion MRI from Head to Toe", Los Angeles, CA, USA, March 4-8, 2022

20) **Hernandez-Garcia L**: "New Developments in Arterial Spin Labeling". British and Irish Chapter of the ISMRM educational series, April 8th, 2022

21) **Hernandez-Garcia L**: "Functional imaging and neuromodulation of the human brain: the long road to an effective closed-loop system", University of Michigan Biomedical Engineering Society Symposium, May 4th, 2023.

22) **Hernandez-Garcia, L:** "Toward layer specific FMRI at 3T : velocity selective ASL and blood volume imaging", guest lecture at Northwestern University's Center for Translational Imaging, Sep. 5, 2023.

23) **Hernandez-Garcia, L:** "Development of Layer Specific FMRI at 3 Tesla (A Work in Progress)", guest lecture at Basque Center on Cognition, Brain and Language, March 18, 2025.

PRESENTATIONS

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131) **Hernandez-Garcia L**, Frey DJ, Nielsen JF, Noll DC: Blood Volume Based Functional MRI Using Velocity Selective Pulses And SERIOS Readout , Proc. ISMRM 2023, n.920

132) Hong, Tao, **Hernandez-Garcia, L**, Fessler JA, A Fast Double Stochastic Proximal Method for CS-MRI Reconstruction with Multiple Wavelets. Proc. ISMRM 2024, 4999

133) Hong,T, Frey D, **Hernandez-Garcia L**, Fessler J. "Optimizing Sampling Trajectories for ASL-MRF: An Unsupervised Way", 2024 SIAM Conference on Imaging Science.

134) Frey D, **Hernandez-Garcia L**. "A Realistic Two-Compartment Perfusion Phantom for Perfusion MRI". ISMRM workshop on Perfusion MRI 2025, n. 34

135) **Hernandez-Garcia L**: "Velocity Spectrum Imaging Using BIR-8 Velocity Selective Pulses". ISMRM workshop on Perfusion MRI 2025, n. 40

136) Griesler T, **Hernandez-Garcia L**, Liu Z, Hamilton J, Chenevert T, Gulani V, Seiberlich N, Cruz G: "Feasibility pf High Temporal Resolution Quantitatice Perfusion Using MR Fingerprinting". ". ISMRM workshop on Perfusion MRI 2025, n. 40

PATENTS/INVENTION DISCLOSURES

1) Schmitthorst, V, Holland S, VanNest J, Hernandez-Garcia, L < Simultaneous ASL/BOLD functional MRI – filed 5/31/2011, Pub. No: 2012/0139537 A1 (25%)

2) Hernandez-Garcia L, Michielssen E, Grbic A, Goez L; Multi-coil Transcranial Magnetic Stimulation - filed 1/13/2014, PCT International Application PCT/14/130,707 (25%)

3) Hernandez-Garcia L, Wright K, Griswold M, Gulani V, Ma D: Arterial Spin Labeling with MR Fingerprinting: Simultaneous Quantification of CBF, Transit Time and T1, disclosed on 3/28/2014 at Case Western Reserve University, (17%)

4) Allen S, Hall, T, Cain C, Hernandez-Garcia L: Detecting and Localizing Ultrasound Bubble Clouds Using Magnetic Resonance Imaging,(33%) disclosed July 10, 2015 to Tech Transfer Office at UM.

Ph.D. Committees chaired/co-chaired

1) Gregory Lee, Spring 2007, "Functional Magnetic Resonance Imaging with Arterial Spin Labeling: A novel pulse sequence and quantitative model". Co-chair, Current position: Assistant Professor, Radiology, Cincinnati Children's Hospital Medical Center.
2) Hesamoddin Jahanian, Spring 2012, "Functional MRI using pseudo-continuous arterial spin labeling". Co-chair, Current Position: Research Fellow, Department of Radiology, Stanford University.
3) Jonas Schollenberger, Winter 2021, "Characterization of Cerebral Hemodynamics using a Computational Fluid Dynamics and Arterial Spin Labeling MRI Strategy: Applications in Cerebrovascular Occlusive Disease"
4) Anish Lahiri, Winter 2021, "Learning-based Algorithms for Inverse Problems in MR Image Reconstruction and Quantitative Perfusion Imaging"

Other Ph.D. committee membership

1) Alberto Vazquez, 2005, "The dynamics of the blood oxygenation response in functional magnetic resonance imaging", Research Assistant Professor, Neurobiology and Radiology, University of Pittsburgh.
2) Timothy Hall, 2007, "Histotripsy: non-invasive ultrasound surgery", Assistant Research Scientist, University of Michigan.
3) Michael Franklin, 2008, "The representation and processing of order information in memory"
4) Kiran Pandey, 2009, "Mitigation of Motion Artifacts in Functional MRI: A Combined Acquisition, Reconstruction and Post Processing Approach "
5) Yoon-Chung Kim, 2011, "Non-Cartesian parallel image reconstruction for functional MRI"
6) Elise Demeter, 2011, "Translational research on sustained attention and attentional control in rats, healthy humans and patients with schizophrenia", current position, post doctoral associate, cognitive neuroscience.
7) Emre Demiralp, 2012, "Structure and Dynamics of Emotional Experience in Depression"
8) Siamak Davarani, 2013, "Parametric Modeling of the Brain Vascular System and its Application in Dynamic Contrast-Enhanced Imaging Studies "
9) Luis Gomez, 2014, "Computational electromagnetic tools for transcranial magnetic stimulation"
10) Angela Harrivel, 2014, "Monitoring attentional state with functional near infrared spectroscopy",
11) Yash Shah, 2015, "Methods and Applications of Multivariate Pattern Analysis in Functional MRI Data Analysis"
12) Steven Allen, 2016, "Magnetic Resonance Imaging Guidance for Histotripsy Therapy"
13) Matthew Muckley, 2016, "Acceleration Methods for MRI"
14) Rachel Surowiec, 2019, "Novel Models to Image and Quantify Bone Drug Efficacy and Disease Progression In Vivo: Addressing the Fragility Phenotype"
15) Yige Li, 2019, "Monopolar Acoustic Pulses in Histotripsy and Other Applications"
16) Josiah Simeth, 2020, "Quantifying Regional and Global Liver Function Via Gadoxetic Acid Uptake"
17) Sofia Guterres, 2020, "Brain perfusion imaging using pseudo-continuous arterial spin labelling MRI: impact of coil shimming of the labelling region "(Biomedical Enginerring, Universidade de Lisboa, Libon, Portugal)

18) Nicholas Luciw, 2022, "Arterial Spin-Labelled MRI Analyses to Advance Adolescent Bipolar Disorder Research and Clinical Applications", (Department of Medical Biophysics, University of Toronto, Toronto, Canada)

GRANT SUPPORT HISTORY

"Modeling the BOLD Response Accounting for Perfusion Effects: Simultaneous BOLD imaging and two-coil Arterial Spin Labeling"

UM Center for Biomedical Engineering Research. (PI: **Hernandez**), 1/1/2000 – 1/1/2001

The BOLD effect is a combination of several phenomena associated with increased brain activity that result in a subtle signal change (~5-10 %). These phenomena include an increase in blood flow to the active region, and a change in the T2* relaxation constant, due to the increase in deoxy-hemoglobin. In this project we propose a model that treats the vascular bed as an expandable compartment, where changes in blood flow affect the volume of the compartment. Blood flow is an essential parameter of our model and a direct measurement would help assess its validity. Here we propose an implementation of the ASL method to measure the blood flow component of the BOLD effect, rapid and continuously that will help us verify our model, and that can be employed for ASL-based functional imaging experiments.

"Forebrain mechanism in chronic non-neuropathic pain" (10%)

(National Institutes of Health 5R01AR46045-02 (P.I.: Casey) 9/30/00-8/31/03

The major goal of this project is to identify mechanisms for pain perception differentiate between pain responses in normal subjects and patients who suffer from chronic neuropathic pain. This project also aims to differentiate the neural substrates of the slow and fast pain responses. My role on the project as co-investigator is to design and conduct the functional MRI experiments described in the project. I am also responsible for the fMRI data processing and analyses.

"Elimination of Head Movement Artifact in fMRI" (20%)

National Institutes of Health, PI: D. Noll 09/30/03-9/28/08

The long-term goal of this project is to develop image acquisition protocols, reconstruction approaches and post-processing methods that will improve on the effectiveness of head movement correction in fMRI.

"Signal Recovery in Susceptibility Based Functional MRI" (20%)

National Institutes of Health R01 DA15410-01 (P.I.:Noll) 7/1/02-6/30/07

This project involves the development of methods for improved imaging in inferior frontal cortex, inferior and medial temporal lobes, and brain stem areas.

"Mechanisms in Chronic Multisymptom Illnesses" (10%)

Dept. of Defense DAMD, 17 00 2 0018 (PI: DJ Clauw) 2/01/00 -7/31/05

This multi-phase investigation seeks to identify physiological and psychological factors contributing to the spectrum of illness known as CMI. Part 1 involves cross-sectional investigations of physiological responses to experimentally induced stressors. Part 2 involves pharmaceutical and non-pharmaceutical treatment trials for CMI. This includes web-based and telemedicine implementations of cognitive behavioral therapy (CBT) and exercise protocols. My role is to investigate differences in cerebral perfusion between controls and patients at baseline and during noxious stimulation.

"Fast, Quantitative Perfusion-Based functional MRI" (30%)

National Institutes of Health, 1 R01 EB004346-01 (PI: **Hernandez**) 7/1/05-6/30/08

This project proposes a system to perform rapid event related fMRI experiments using arterial spin labeling techniques with optimum SNR and speed. The new methods will require a new modeling approach for quantification. The project also aims to characterize the perfusion response function to neuronal activity, and to study the noise properties of ASL time series data.

"MRI Parallel Excitation for Neuroimaging Applications" (20%)

National Institutes of Health, RFA : PAR-04-023, (PI: Noll) 4/1/07-3/31/12

A Bioengineering Research Partnership is proposed for the development of parallel excitation technology to improve fMRI studies in orbitofrontal cortex, with a specific emphasis on neuroimaging or loss related processes in patients with OCD. This project is motivated by the large signal voids caused by magnetic susceptibility differences between tissue and air in the nasal sinuses. These artifacts are ubiquitous in fMRI for many inferior brain structures and the frontal pole. This project is further motivated by the upward trend in MRI towards using higher magnetic field systems, which improves sensitivity in many parts of the brain, but also exacerbates the susceptibility artifacts. This project will develop parallel excitation techniques to remove these artifacts at all field strengths. Success in this project will lead to valuable new methods for probing the whole brain with equal sensitivity, thus aiding the study of of brain regions implicated in OCD among other disorders.

"Dosimetry and Improved Targeting for Transcranial Magnetic Stimulation" (15%)

National Institutes of Health, 1R21NS058691 (PI: **Hernandez**) 7/1/08–6/31/10

This project is a step toward a new generation of Transcranial Magnetic Stimulation techniques to stimulate the desired brain regions with greater precision and accuracy, with minimal stimulation of unwanted regions. The project consists of the development of computational and imaging techniques to measure the fields generated by TMS stimulation. Using these techniques, the project will optimize design parameters of TMS devices considering shielding techniques and novel electromagnetic lenses made of meta-materials

"Imaging Feedback to Guide Ultrasonic Tissue Fractionation for Cancer Therapy" (15%)

National Institutes of Health (R01 CA134579) PI: Cain 7/1/08 – 6/31/13

Histotripsy is the controlled use of ultrasound cavitation to mechanically fractionate tissue volumes non-invasively under image guidance. The effects can be easily seen and characterized by histological analysis and chronic animal studies where some clinical "outcome" can be determined. In this project, we will develop methods to predict clinical outcome from image parameters available both during and after treatment. This will provide an answer to the critical question for most noninvasive ablative technologies, i.e., when should the treatment be stopped and what will be the spatial extent of the desired treatment? Development of these image guidance techniques could result in a significant transformation in the effectiveness of ablative therapies in a wide range of clinical applications, e.g., prostate cancer, benign prostatic hyperplasia (BPH), breast cancer, fibroadenomas of the breast, liver cancer and metastases, kidney cancer, uterine fibroids, thrombolysis, cardiac ablations for arrhythmia control, lung and brain cancer (under certain conditions), treatment of infected wounds and abscesses, etc.

"Development and use of rtfMRI for self-control of nicotine craving" (20% Y1-2, 15% Y3-5)

National Institutes of Health (NINDS 1 R21 DA026077) PI: Peltier 09/01/2008-08/31/2013

This proposal aims to study the application of functional magnetic resonance imaging in real time (rtfMRI) as an operant training feedback mechanism for treating substance use disorders. The present application seeks to expand the investigation of these processes and validate their applicability to substance dependent volunteers. In initial studies we will examine the capacity of nicotine dependent volunteers to

reduce their craving for cigarettes. This substance was selected for its high retention rates and prevalence and public health burden in the general population, but it is expected that future studies would explore other forms of addiction (e.g. cocaine, opiates). The developmental and experimental elements of this proposal will lead to new avenues for treatment that would be readily generalizable to other forms of drug addiction besides nicotine, and potentially impacting on the outcomes of the substantial numbers of individuals seeking substance abuse treatment.

"Improving Fluid Intelligence by Training Working Memory" (5%)

National Science Foundation (0842446) PI: Jonides 10/1/2009-9/30/2011

The goal of this project is to study the brain mechanisms underlying improvement in working memory with training.

"MRI Parallel Excitation for Neuroimaging Applications" (15%)

National Institutes of Health (1R01NS058576) PI: Noll 01/01/2008 – 12/31/2012

A Bioengineering Research Partnership is proposed for the development of parallel excitation technology to improve fMRI studies in orbitofrontal cortex, with a specific emphasis on neuroimaging or loss related processes in patients with OCD. This project is motivated by the large signal voids caused by magnetic susceptibility differences between tissue and air in the nasal sinuses. These artifacts are ubiquitous in fMRI for many inferior brain structures and the frontal pole. This project is further motivated by the upward trend in MRI towards using higher magnetic field systems, which improves sensitivity in many parts of the brain, but also exacerbates the susceptibility artifacts. This project will develop parallel excitation techniques to remove these artifacts at all field strengths. Success in this project will lead to valuable new methods for probing the whole brain with equal sensitivity, thus aiding the study of of brain regions implicated in OCD among other disorders.

Role: Co-Investigator

"Imaging Feedback to Guide Ultrasonic Tissue Fractionation for Cancer Therapy" (14%)

National Institutes of Health (R01 CA134579) PI: Cain 08/04/2008 – 05/31/2013

Histotripsy is the controlled use of ultrasound cavitation to mechanically fractionate tissue volumes non-invasively under image guidance. The effects can be easily seen and characterized by histological analysis and chronic animal studies where some clinical "outcome" can be determined. In this project, we will develop methods to predict clinical outcome from image parameters available both during and after treatment. This will provide an answer to the critical question for most noninvasive ablative technologies, i.e., when should the treatment be stopped and what will be the spatial extent of the desired treatment? Development of these image guidance techniques could result in a significant transformation in the effectiveness of ablative therapies in a wide range of clinical applications, e.g., prostate cancer, benign prostatic hyperplasia (BPH), breast cancer, fibroadenomas of the breast, liver cancer and metastases, kidney cancer, uterine fibroids, thrombolysis, cardiac ablations for arrhythmia control, lung and brain cancer (under certain conditions), treatment of infected wounds and abscesses, etc.

Role: Co-Investigator

"Exploring Tobacco Effects on Attention in Schizophrenics and Controls Using fMRI" (2.5%)

National Institutes of Health, (R03 DA029168) PI: Guthrie 07/01/2011 – 06/30/2012

We propose to use functional MRI to measure cerebral perfusion with arterial spin labeling, an indirect measurement of neuronal activity, in two separate sessions (with subjects) with nicotine and without nicotine.

Role: Co-Investigator

"Image-Guided Noninvasive Ultrasonic Liver Tumor Ablation using histotripsy" (0.6 calendar months)

UM P/G N016316, RSG-13-101-01-CCE (PI: Xu) 07/01/2013 – 06/30/2018

American Cancer Society

Histotripsy produces a millimeter-sized cluster of microbubbles that fractionates the target tissue without damaging the overlying tissue, by using ultrasound pulses applied outside the body and focused to the target tissue. Histotripsy can completely fractionate tumors surrounding major vessels while preserving the vessels.

In this grant, a phased array ultrasound transducer for histotripsy therapy will be designed and built based on the anatomy of liver cancer patients. Using this transducer and excised human liver tumors, parameters will be optimized for large tumor ablation through the intact chest and for vessel-sparing ablation. High sensitivity, real-time imaging-feedback will also be developed to monitor the entire histotripsy treatment. Finally, the response to histotripsy tumor treatment will be investigated in an animal liver tumor model. With the successful completion of the proposed work, histotripsy will become a paradigm changing technology for liver cancer ablation and benefit millions of liver cancer patient worldwide. As a platform technology, histotrispy could be broadened to treat tumors in many other organs, including the breast, prostate, kidney, and brain.

Role: Co-Investigator

"MR-Thermometry of Renaissance Treatment Devices" (15%)

Amway, Access Business Group (PI: **Hernandez-Garcia)** 01/01/2015 – 12/31/2015

The goal of this project is to develop a system of MR thermometry to guide and validate ultrasound therapeutic devices ex vivo and in vivo.

Role: Principal Investigator

"Training in Functional Magnetic Resonance Imaging" (1.0 calendar months)

UM 15-PAF00298, R25 (PI: Jonides) 09/01/2015 – 08/31/2020

National Institutes of Health

This project is to continue to offer an annual two-week short course on functional Magnetic Resonance Imaging at the University of Michigan in August of each year. The curriculum covers the physics of MRI and fMRI, coverage of data acquisition, a detailed presentation of issues having to do with experimental design, and substantial coverage of data analysis and interpretation. Students will get the opportunity to design an experiment, and analyze data that have been gathered previously. The proposed short course will be open to graduate students, post-doctoral fellows, faculty, medical students, and medical residents.

Role: Co-Investigator

"Direct, non-invasive brain stimulation using ultrasound and magnetic field pulses", (10% effort)

University of Michigan, MI-BRAIN initiative, (PI: Hernandez-Garcia, Cain), 9/1/2015 – 9/1/2016

University of Michigan, Recent work shows that one can open ion channels in neural tissue using mechanical vibration in order to produce action potentials. There is a small but exciting body of literature on this area, but the potential of this technology is tremendous. The goal of this project is develop that technology, but more importantly, to construct a biophysical model of the biophysics underlying the phenomenon.

Role: co-principal investigator.

"Quantitative blood flow imaging using Spin Labeled MR Fingerprinting" 3/1/2016 to 2/18/2018

National Institutes of Health (R21EB021562), (PI Hernandez-Garcia)

This proposal seeks to develop a new strategy for Arterial Spin Labeling Perfusion imaging based on newly developed MR fingerprinting techniques. These techniques will allow the estimation of multiple hemodynamic parameters linked to brain function. Success in this proposal will translate into a new robust perfusion imaging technique that can be made readily available in most clinical and research MRI scanners. The new technique will permit physicians and scientists to obtain quantitative images of multiple vascular parameters, such as blood flow and blood volume. These quantitative images will provide fundamental data to diagnose and characterize multiple neurodegenerative disorders early in the process, as well as to determine treatment efficacy.

"Enhancing Cognitive Training with Transcranial Direct Current Stimulation" (5% effort)

National Science Foundation 1658268 (PI: Jonides)

4/1/2017 – 6/31/2020

Enhancing cognitive performance via cognitive training has become a promising yet quite controversial field of inquiry. Some have proposed that non-invasive brain stimulation may be used as an adjuvant tool to enhance the effects of cognitive training. This has been met with some initial success (Richmond et al., 2014; Park et al., 2014; Martin et al., 2013; Jones et al., 2015), though these early studies are not yet conclusive. Our own preliminary research has documented a robust enhancement effect of one non-invasive stimulation technique, transcranial direct current stimulation (tDCS) during seven days of training on a WM task (Au et al., 2016). Furthermore, this same research has shown that this enhancement effect is maintained approximately a year after training, without any intervening training or stimulation.

Role: Co-Investigator

"Novel Ultrasonic Technique for the Treatment of Hemorrhagic Stroke" (5% effort)

NIH R01 NS108042 (PI: Pandey)

09/30/2018 – 07/31/2023

The rupture of blood vessels in the brain can lead to bleeding and clotting (hematoma) inside the brain, termed as hemorrhagic stroke or intracerebral hemorrhage (ICH). ICH accounts for 10-15% of all strokes and is particularly devastating, leading to a 30-day survival rate of 30-50%. The goal of this proposal is to develop a new, minimally invasive, ultrasonic technique that can allow of liquefaction of the ICH thus allowing it to be removed via a ventriculostomy catheter placement thus reducing brain compression from the ICH as well as minimizing secondary effects of blood products within the brain.

Role: Co-Investigator

"Theta burst transcranial magnetic stimulation of fronto-parietal networks: Modulation by mental state" (5% effort)

NIMH R01 (PI: Taylor) 07/01/2019 – 06/30/2021

0.48 CM (Yrs 1-2)

This proposal will use functional magnetic resonance imaging to examine the effects of transcranial magnetic stimulation (TMS) on specific brain networks relevant for neuropsychiatric conditions. We will test the broad hypothesis that when TMS is applied to a brain in a controlled mental state, network changes induced by TMS will be facilitated, compared to stimulation when mental state is uncontrolled. Results from this study will be used to optimize TMS therapy for depression by controlling mental state to improve the efficacy of TMS treatment.

Role: Co-Investigator

"Multi-modal assessment of GABA function in psychosis" (5% effort)

P30 AG072931 (PI: Taylor) 07/01/2019 – 06/30/2024

NIH/NIMH

Although post-mortem work and functional studies have consistently implicated GABAergic dysfunction in the psychosis spectrum (schizophrenia, schizoaffective disorder and bipolar disorder), the nature and extent of these disruptions remains unclear. Using converging MRI measures of GABA function (pharmacologic challenge with functional magnetic resonance imaging and magnetic resonance spectroscopy), this project will undertake the first in vivo study of GABAergic systems across the psychosis spectrum. Pursuing preliminary data linking alterations in GABA function with persistent negative affects in psychosis patients, the study will establish critical foundation work for the development of pharmacologic and clinical targets to ameliorate the serious disturbances caused by psychosis syndromes.

Role: Co- Investigator

"Quantitative MR Imaging of Vascular Factors in Parkinson's Disease" (20%)

(PI: **Hernandez-Garcia**) 09/30/2020 - 06/30/2025

National Institutes of Health

R01NS112233

Role: Principal Investigator

Vascular health has been shown to be an important factor in the development of neurodegenerative diseases like Alzheimer's and Parkinson's diseases. Hence, the ability to measure reliably and quantitatively early hemodynamic changes in the aging brain can be a powerful tool for diagnosing, studying, and developing treatments. Arterial Spin Labeling (ASL) magnetic resonance imaging can yield quantitative perfusion images without the use of contrast agents. We propose that combining new ASL techniques, such as Velocity Selective Inversion (VSI) labeling pulses and magnetic resonance fingerprinting (MRF) with deep learning regression methods will allow quantification of multiple hemodynamic parameters beyond perfusion, thus providing a much more nuanced picture of the state of the vasculature. We also expect that the new technique will offer dramatic improvements in SNR, specificity and sensitivity of ASL, and that the proposed techniques will have many other applications in research and in the clinic. We propose to use these techniques to fill the knowledge gap regarding the relationship between vascular changes and Parkinson's disease and its symptoms, particularly fatigue, whose pathogenesis is not well understood. If we are successful in this application, future work will use the hemodynamic parameters of interest as biomarkers to assess risk of neurodegeneration, determine therapeutic targets, and guide in the development of new therapies.

"Michigan Alzheimer's Disease Research Center" (2.5%)

(PI: Paulson, Henry) 9/2021 – 5/2026

National Institutes of Health : P30 AG072931

Role: co-investigator

Major Goals: Alzheimer's disease and related dementias (ADRD) represent one of the greatest health problems in the United States and the state of Michigan. Building on longstanding strengths in dementia research, outreach and training at three universities working as a consortium, the Michigan ADRC will lead a regional effort to identify, understand and modulate the many factors beyond β-amyloid that contribute to brain dysfunction and degeneration in ADRD.

Title: Development of Layer Specific FMRI for clinical scanners (10%)

PI: **Luis Hernandez-Garcia**

Role : Principal Investigator 9/2023-2/2025

National Institutes of Health: R21EB032514

Layer Specific FMRI is a new and exciting tool to probe mesoscale brain networks non-invasively, without the need for invasive surgical procedures, such as electrode implantation, or confocal microscopy. Recent work has demonstrated the Layer Specific FMRI can identify both the columnar, as well as layer specific structure of a network. While the field of Layer Specific FMRI is dominated by “ultra-high” field MRI scanners (7T and above), it is still extremely challenging to achieve those results in 3T scanners because of their reduced signal:noise ratio (SNR). The need for ultra-high field scanners stems from the requirement of extremely small voxels for layer specific FMRI, which translates into a dramatic loss of SNR.

This need for ultra high field scanners means that much of it has to be carried out on small animals, and human work in this area is limited to a few select institutions. The goal of this proposal is to develop the technology needed to make layer specific FMRI feasible at 3T scanners, common in most research institutions. Our proposed strategy is to improve SNR efficiency and reduce scan time by using a reduced field of view, 3D read-out in tandem with a new positive vascular contrast imaging method based on Velocity Selective pulses to collect arterial blood volume weighted images much faster. At the same time, we will also aim to reduce the noise of the measurement by an efficient echo correction technique.

Title: 2025 ISMRM Workshop on Perfusion MRI: Found in Translation (0% salary)

Co-PI: **Luis Hernandez-Garcia**, Qin, Qin

Role: Co-principal investigator (03/01/2025 -02/28/2026)

National Institutes of Health: R13EB036892

We propose to hold an International Society for Magnetic Resonance in Medicine (ISMRM) Workshop titled "Perfusion MRI: Found in Translation" in Pamplona, Navarra, Spain. Perfusion MRI provides important diagnostic biomarkers in many diseases throughout the body, beyond those available from standard anatomic MRI. The significance of Perfusion MRI has been extended to all specialties of medicine. The purpose of the proposed ISMRM Perfusion MRI Workshop is to bring together scientists and clinicians interested in technical research and application-oriented innovations in perfusion MRI. The Workshop has three aims: Aim 1 is to organize an interdisciplinary international workshop highlighting the opportunities and challenges of perfusion MRI; Aim 2 is to discuss the key questions and gaps in the Perfusion MRI field to guide future research and clinical applications; Aim 3 is to promote harmonization of imaging protocols and disseminate existing tools for the analysis of perfusion data and training resources related to perfusion imaging techniques. This workshop will be of great interest to the clinical community, such as neurology, psychiatry, oncology, cardiology, nephrology, pulmonology, hematology, and orthopedics. The organizing committee consists of a diverse group of scientists and clinicians with inclusion of women and underrepresented minorities as well as a mixture of junior and senior investigators. A diverse panel of world renowned scientists and clinicians will present their research in methodologies and applications of perfusion MRI. The Workshop will be CME accredited. The Workshop will employ several novel approaches. Scientific presentations will be combined with new socializing and networking methods to provide ample opportunities of discussion, collaboration, and brainstorming. To maximize the impact of the Workshop on the scientific community and to move the perfusion MRI field forward, we will set concrete goals. Therefore, the 2025 Perfusion MRI Workshop will be a timely event to unify and further publicize recent efforts in perfusion MRI, and to disseminate open source tools for perfusion image processing and analysis. By holding panel discussions with industry vendors, we expect to set much-needed standards for the implementation of perfusion protocols across platforms.