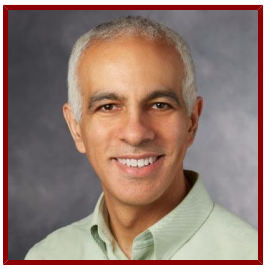
Stanford



Michael Zeineh

Associate Professor of Radiology (Neuroimaging and Neurointervention)

CLINICAL OFFICE (PRIMARY)

- **Clinical Neuroradiology**

  300 Pasteur Dr

  MC 5105

  Stanford, CA 94305

  Tel (650) 724-1021 **Fax** (650) 723-1523

Bio

BIO

Dr. Michael Zeineh received a B.S. in Biology at Caltech in 1995 and obtained his M.D.-Ph.D. from UCLA in 2003. After internship also at UCLA, he went on to radiology residency and neuroradiology fellowship both at Stanford. He has been faculty in Stanford Neuroradiology since 2010. He spearheads many initiatives in advanced clinical imaging at Stanford, including clinical fMRI and DTI. Simultaneously, he runs a lab with the goal of discovering new imaging abnormalities in neurodegenerative disorders, with a focus on detailed microcircuitry in regions such as the hippocampal formation using advanced, multi-modal in vivo and ex vivo methods, with applications to neurodegenerative disorders such as Alzheimer’s disease and mild traumatic brain injury.

CLINICAL FOCUS

- Clinical Functional MRI
- Clinical Diffusion Tensor Imaging
- Diagnostic Radiology

ACADEMIC APPOINTMENTS

- Associate Professor - University Medical Line, Radiology
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- Clinical Scientist Development Award, Doris Duke Charitable Foundation (7/1/15-6/30/18)
- Research Scholar Award, RSNA (7/1/13-6/30/16)
- ISMRM Clinical Stipend, International Society for Magnetic Resonance in Medicine (2013)
- ISMRM Clinical Stipend, International Society for Magnetic Resonance in Medicine (2012)
- ISMRM Clinical Stipend, International Society for Magnetic Resonance in Medicine (2011)

- ISMRM Travel Award, International Society for Magnetic Resonance in Medicine (2010)
- Emil Bogen Research Prize, UCLA (2003)
- Western Student Medical Research Forum, Bertakis Speaker Award (2002)
- Burroughs Wellcome Travel Award for Research in England, Burroughs Wellcome Fund (2001)
- Human Brain Mapping Travel Award, Organization for Human Brain Mapping (2001)
- Kavan Prize for Neuroscience, UCLA (2001)
- Hortense Fischbaugh Pollack Scholarship, UCLA (2000)
- NIMH NRSA MH12167 (Bookheimer PI) Project: Unfolding the Human Hippocampus with Functional MRI, National Institutes of Health (NIH) (1998-2000)
- Merit Award/Scholarship, Caltech (1994-1995)
- Summer Undergraduate Research Fellowship, Caltech (1994)
- Merit Award/Scholarship, Caltech (1993-1994)
- Barry M. Goldwater Scholarship, Servite High School (1993)
- Tau Beta Pi, Caltech (1993)

PROFESSIONAL EDUCATION

- Internship: UCLA GME Office (2004) CA
- Medical Education: UCLA GME Office (2003) CA
- Board Certification: Neuroradiology, American Board of Radiology (2011)
- Fellowship: Stanford University - Fellowship (2009) CA
- Board Certification: Diagnostic Radiology, American Board of Radiology (2008)
- Residency: Stanford University - Fellowship (2008) CA

LINKS

- My Lab Website: http://med.stanford.edu/zeinehlab.html

Teaching

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Mahta Karimpoor

Doctoral Dissertation Co-Advisor (NonAC)

Yixin Wang

Doctoral Dissertation Reader (NonAC)

Nicholas Cecchi, Xianghao Zhan

Publications

PUBLICATIONS

- **Microstructural Alterations in Tract Development in College Football and Volleyball Players: A Longitudinal Diffusion MRI Study.** *Neurology*
  Goubran, M., Mills, B. D., Georgiadis, M., Karimpoor, M., Mouchawar, N., Sami, S., Dennis, E. L., Akers, C., Mitchell, L., Boldt, B., Douglas, D., DiGiacomo, P. S., Rosenberg, et al
  2023

- **Longitudinal alterations of cerebral blood flow in high-contact sports.** *Annals of neurology*

Karimpoor, M., Georgiadis, M., Zhao, M. Y., Goubran, M., Moein Taghavi, H., Mills, B. D., Tran, D., Mouchawar, N., Sami, S., Wintermark, M., Grant, G., Camarillo, D. B., Moseley, et al

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- **Using light and X-ray scattering to untangle complex neuronal orientations and validate diffusion MRI.** *eLife*

  Menzel, M., GraSSel, D., Rajkovic, I., Zeineh, M. M., Georgiadis, M.

  2023; 12

- **Imaging crossing fibers in mouse, pig, monkey, and human brain using small-angle X-ray scattering.** *Acta biomaterialia*

  Georgiadis, M., Menzel, M., Reuter, J. A., Born, D., Kovacevich, S., Alvarez, D., Taghavi, H. M., Schroeter, A., Rudin, M., Gao, Z., Guizar-Sicairos, M., Weiss, T. M., Axer, et al

  2023

- **Medial Temporal Lobe Anatomy.** *Neuroimaging clinics of North America*

  van Staalduinen, E. K., Zeineh, M. M.

  2022; 32 (3): 475-489

- **Iron and Alzheimer's Disease: From Pathology to Imaging.** *Frontiers in human neuroscience*

  Tran, D., DiGiacomo, P., Born, D. E., Georgiadis, M., Zeineh, M.

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- **The Presence of the Temporal Horn Exacerbates the Vulnerability of Hippocampus During Head Impacts.** *Frontiers in bioengineering and biotechnology*

  Zhou, Z., Li, X., Domel, A. G., Dennis, E. L., Georgiadis, M., Liu, Y., Raymond, S. J., Grant, G., Kleiven, S., Camarillo, D., Zeineh, M.

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- **Neuroradiologic Evaluation of MRI in High-Contact Sports.** *Frontiers in neurology*

  McAllister, D., Akers, C., Boldt, B., Mitchell, L. A., Tranvinh, E., Douglas, D., Goubran, M., Rosenberg, J., Georgiadis, M., Karimpoor, M., DiGiacomo, P., Mouchawar, N., Grant, et al

  2021; 12: 701948

- **Neuroradiologic Evaluation of MRI in High-Contact Sports** *FRONTIERS IN NEUROLOGY*

  McAllister, D., Akers, C., Boldt, B., Mitchell, L. A., Tranvinh, E., Douglas, D., Goubran, M., Rosenberg, J., Georgiadis, M., Karimpoor, M., DiGiacomo, P., Mouchawar, N., Grant, et al

  2021; 12

- **Nusinersen Treatment in Adults With Spinal Muscular Atrophy.** *Neurology. Clinical practice*

  Duong, T., Wolford, C., McDermott, M. P., Macpherson, C. E., Pasternak, A., Glanzman, A. M., Martens, W. B., Kichula, E., Darras, B. T., De Vivo, D. C., Zolkipli-Cunningham, Z., Finkel, R. S., Zeineh, et al

  2021; 11 (3): e317-e327

- **Nanostructure-specific X-ray tomography reveals myelin levels, integrity and axon orientations in mouse and human nervous tissue.** *Nature communications*

  Georgiadis, M., Schroeter, A., Gao, Z., Guizar-Sicairos, M., Liebi, M., Leuze, C., McNab, J. A., Balolia, A., Veraart, J., Ades-Aron, B., Kim, S., Shepherd, T., Lee, et al

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- **Exploring valence states of abnormal mineral deposits in biological tissues using correlative microscopy and spectroscopy techniques: A case study on ferritin and iron deposits from Alzheimer's disease patients.** *Ultramicroscopy*

  Zeng, Y., DiGiacomo, P. S., Madsen, S. J., Zeineh, M. M., Sinclair, R.

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- **Hippocampal subfield imaging and fractional anisotropy show parallel changes in Alzheimer's disease tau progression using simultaneous tau-PET/MRI at 3T.** *Alzheimer's & dementia (Amsterdam, Netherlands)*

  Carlson, M. L., Toueg, T. N., Khalighi, M. M., Castillo, J., Shen, B., Azevedo, E. C., DiGiacomo, P., Mouchawar, N., Chau, G., Zaharchuk, G., James, M. L., Mormino, E. C., Zeineh, et al

  2021; 13 (1): e12218

- **Comparison of diffusion MRI and CLARITY fiber orientation estimates in both gray and white matter regions of human and primate brain.** *NeuroImage*

  Leuze, C., Goubran, M., Barakovic, M., Aswendt, M., Tian, Q., Hsueh, B., Crow, A., Weber, E. M., Steinberg, G. K., Zeineh, M., Plowey, E. D., Daducci, A., Innocenti, et al

  2020; 228: 117692

- **Correlative Microscopy to Localize and Characterize Iron Deposition in Alzheimer's Disease.** *Journal of Alzheimer's disease reports*
  Madsen, S. J., DiGiacomo, P. S., Zeng, Y., Goubran, M., Chen, Y., Rutt, B. K., Born, D., Vogel, H., Sinclair, R., Zeineh, M. M.
  2020; 4 (1): 525–36

- **COVID-19-induced anosmia associated with olfactory bulb atrophy.** *Neuroradiology*
  Chiu, A., Fischbein, N., Wintermark, M., Zaharchuk, G., Yun, P. T., Zeineh, M.
  2020

- **Simultaneous FDG-PET/MRI detects hippocampal subfield metabolic differences in AD/MCI.** *Scientific reports*
  Carlson, M. L., DiGiacomo, P. S., Fan, A. P., Goubran, M., Khalighi, M. M., Chao, S. Z., Vasanawala, M., Wintermark, M., Mormino, E., Zaharchuk, G., James, M. L., Zeineh, M. M.
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- **Deep Flow-Net for EPI Distortion Estimation.** *NeuroImage*
  Zahneisen, B., Baeumler, K., Zaharchuk, G., Fleischmann, D., Zeineh, M.
  2020: 116886

- **Tau PET imaging with 18F-PI-2620 in aging and neurodegenerative diseases.** *European journal of nuclear medicine and molecular imaging*
  Mormino, E. C., Toueg, T. N., Azevedo, C. n., Castillo, J. B., Guo, W. n., Nadiadwala, A. n., Corso, N. K., Hall, J. N., Fan, A. n., Trelle, A. N., Harrison, M. B., Hunt, M. P., Sha, et al
  2020

- **A within-coil optical prospective motion-correction system for brain imaging at 7T.** *Magnetic resonance in medicine*
  DiGiacomo, P. n., Maclaren, J. n., Aksoy, M. n., Tong, E. n., Carlson, M. n., Lanzman, B. n., Hashmi, S. n., Watkins, R. n., Rosenberg, J. n., Burns, B. n., Skloss, T. W., Rettmann, D. n., Rutt, et al
  2020

- **Longitudinal alteration of cortical thickness and volume in high-impact sports.** *NeuroImage*
  Mills, B. D., Goubran, M. n., Parivash, S. N., Dennis, E. L., Rezaii, P. n., Akers, C. n., Bian, W. n., Mitchell, L. A., Boldt, B. n., Douglas, D. n., Sami, S. n., Mouchawar, N. n., Wilson, et al
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- **Lateral impacts correlate with falx cerebri displacement and corpus callosum trauma in sports-related concussions.** *Biomechanics and modeling in mechanobiology*
  Hernandez, F., Giordano, C., Goubran, M., Parivash, S., Grant, G., Zeineh, M., Camarillo, D.
  2019

- **Multimodal image registration and connectivity analysis for integration of connectomic data from microscopy to MRI.** *Nature communications*
  Goubran, M. n., Leuze, C. n., Hsueh, B. n., Aswendt, M. n., Ye, L. n., Tian, Q. n., Cheng, M. Y., Crow, A. n., Steinberg, G. K., McNab, J. A., Deisseroth, K. n., Zeineh, M. n.
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- **MR susceptibility contrast imaging using a 2D simultaneous multi-slice gradient-echo sequence at 7T.** *PloS one*
  Bian, W., Kerr, A. B., Tranvinh, E., Parivash, S., Zahneisen, B., Han, M. H., Lock, C. B., Goubran, M., Zhu, K., Rutt, B. K., Zeineh, M. M.
  2019; 14 (7): e0219705

- **Longitudinal changes in hippocampal subfield volume associated with collegiate football.** *Journal of neurotrauma*
  Parivash, S. N., Goubran, M. n., Mills, B. D., Rezaii, P. n., Thaler, C. n., Wolman, D. n., Bian, W. n., Mitchell, L. A., Boldt, B. n., Douglas, D. n., Wilson, E. n., Choi, J. n., Xie, et al
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- **Neuroimaging Radiological Interpretation System for Acute Traumatic Brain Injury** *JOURNAL OF NEUROTRAUMA*
  Wintermark, M., Li, Y., Ding, V. Y., Xu, Y., Jiang, B., Ball, R. L., Zeineh, M., Gean, A., Sanelli, P.
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- **Diffusion MRI tractography for improved transcranial MRI-guided focused ultrasound thalamotomy targeting for essential tremor** *NEUROIMAGE-CLINICAL*
  Tian, Q., Wintermark, M., Elias, W., Ghanouni, P., Halpern, C. H., Henderson, J. M., Huss, D. S., Goubran, M., Thaler, C., Airan, R., Zeineh, M., Pauly, K., McNab, et al
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- **Direct Visualization and Mapping of the Spatial Course of Fiber Tracts at Microscopic Resolution in the Human Hippocampus** *CEREBRAL CORTEX*
  Zeineh, M. M., Palomero-Gallagher, N., Axer, M., Graessel, D., Goubran, M., Wree, A., Woods, R., Amunts, K., Zilles, K.
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- **The "White Gray Sign" Identifies the Central Sulcus on 3T High-Resolution T1-Weighted Images** *AMERICAN JOURNAL OF NEURORADIOLOGY*
  Kaneko, O. F., Fischbein, N. J., Rosenberg, J., Wintermark, M., Zeineh, M. M.
  2017; 38 (2): 276-280
- **In Vivo 7T MR Quantitative Susceptibility Mapping Reveals Opposite Susceptibility Contrast between Cortical and White Matter Lesions in Multiple Sclerosis** *AMERICAN JOURNAL OF NEURORADIOLOGY*
  Bian, W., Tranvinh, E., Tourdias, T., Han, M., Liu, T., Wang, Y., Rutt, B., Zeineh, M. M.
  2016; 37 (10): 1808-1815
- **Seven-Tesla MRI and neuroimaging biomarkers for Alzheimer's disease** *NEUROSURGICAL FOCUS*
  Ali, R., Goubran, M., Choudhri, O., Zeineh, M. M.
  2015; 39 (5)
- **Activated iron-containing microglia in the human hippocampus identified by magnetic resonance imaging in Alzheimer disease.** *Neurobiology of aging*
  Zeineh, M. M., Chen, Y., Kitzler, H. H., Hammond, R., Vogel, H., Rutt, B. K.
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- **Ultra-high resolution in-vivo 7.0 T structural imaging of the human hippocampus reveals the endfolial pathway** *NEUROIMAGE*
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- **Right arcuate fasciculus abnormality in chronic fatigue syndrome.** *Radiology*
  Zeineh, M. M., Kang, J., Atlas, S. W., Raman, M. M., Reiss, A. L., Norris, J. L., Valencia, I., Montoya, J. G.
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- **Ultrahigh-resolution imaging of the human brain with phase-cycled balanced steady-state free precession at 7 T.** *Investigative radiology*
  Zeineh, M. M., Parekh, M. B., Zaharchuk, G., Su, J. H., Rosenberg, J., Fischbein, N. J., Rutt, B. K.
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- **Ultra-high resolution diffusion tensor imaging of the microscopic pathways of the medial temporal lobe** *NEUROIMAGE*
  Zeineh, M. M., Holdsworth, S., Skare, S., Atlas, S. W., Bammer, R.
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- **Advances in high-resolution imaging and computational unfolding of the human hippocampus** *NEUROIMAGE*
  Ekstrom, A. D., Bazih, A. J., Suthana, N. A., Al-Hakim, R., Ogura, K., Zeineh, M., Burggren, A. C., Bookheimer, S. Y.
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- **Reduced cortical thickness in hippocampal subregions among cognitively normal apolipoprotein E e4 carriers** *NEUROIMAGE*
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- **A dissociation of encoding and retrieval processes in the human hippocampus** *JOURNAL OF NEUROSCIENCE*
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- **Dynamics of the hippocampus during encoding and retrieval of face-name pairs** *SCIENCE*
  Zeineh, M. M., Engel, S. A., Thompson, P. M., Bookheimer, S. Y.
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- **Application of cortical unfolding techniques to functional MRI of the human hippocampal region** *NEUROIMAGE*
  Zeineh, M. M., Engel, S. A., Bookheimer, S. Y.
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- **Padded Helmet Shell Covers in American Football: A Comprehensive Laboratory Evaluation with Preliminary On-Field Findings.** *Annals of biomedical engineering*
  Cecchi, N. J., Callan, A. A., Watson, L. P., Liu, Y., Zhan, X., Vegesna, R. V., Pang, C., Le Flao, E., Grant, G. A., Zeineh, M. M., Camarillo, D. B.

2023

- **Machine-learning-based head impact subtyping based on the spectral densities of the measurable head kinematics.** *Journal of sport and health science*
  Zhan, X., Li, Y., Liu, Y., Cecchi, N. J., Raymond, S. J., Zhou, Z., Alizadeh, H. V., Ruan, J., Barbat, S., Tiernan, S., Gevaert, O., Zeineh, M. M., Grant, et al
  2023

- **Cardiogenic control of affective behavioural state.** *Nature*
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- **Laboratory And On-field Testing Of A Commercially Available Padded Helmet Cover**
  Cecchi, N. J., Callan, A. A., Watson, L. P., Liu, Y., Zhan, X., Zeineh, M. M., Grant, G. A., Camarillo, D. B.
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- **Piecewise Multivariate Linearity Between Kinematic Features and Cumulative Strain Damage Measure (CSDM) Across Different Types of Head Impacts.** *Annals of biomedical engineering*
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- **High-resolution hippocampal diffusion tensor imaging of mesial temporal sclerosis in refractory epilepsy.** *Epilepsia*
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- **Changes In The Cerebello-thalamo-cortical Network After MR-guided Focused Ultrasound Thalamotomy.** *Brain connectivity*
  Thaler, C., Tian, Q., WIntermark, M., Ghanouni, P., Halpern, C., Henderson, J., Airan, R., Zeineh, M., Goubran, M., Leuze, C., Fiehler, J., Butts Pauly, K., McNab, et al
  2022

- **A REAL-TIME SYSTEM TO MONITOR BRAIN STRAIN TO DETECT DANGEROUS HEAD IMPACTS**
  Zhan, X., Liu, Y., Gevaert, O., Zeineh, M., Camarillo, D.
  MARY ANN LIEBERT, INC.2022: A22

- **Magnetic resonance imaging-guided laser interstitial thermal therapy for refractory focal epilepsy in a patient with a fully implanted RNS system: illustrative case.** *Journal of neurosurgery. Case lessons*
  Buch, V. P., Mirro, E. A., Purger, D. A., Zeineh, M., Wilmer-Fierro, K., Razavi, B., Halpern, C. H.
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- **Find the spatial co-variation of brain deformation with principal component analysis.** *IEEE transactions on bio-medical engineering*
  Zhan, X., Liu, Y., Cecchi, N. J., Gevaert, O., Zeineh, M., Grant, G., Camarillo, D. B.
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- **Physics-Informed Machine Learning Improves Detection of Head Impacts.** *Annals of biomedical engineering*
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- **Investigating Simultaneity for Deep Learning-Enhanced Actual Ultra-Low-Dose Amyloid PET/MR Imaging.** *AJNR. American journal of neuroradiology*
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- **Translational models of mild traumatic brain injury tissue biomechanics** *Current Opinion in Biomedical Engineering*
  Zhan, X., Oeur, A., Liu, Y., Zeineh, M. M., Grant, G. A., Margulies, S. S., Camarillo, D. B.
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- **Towards a comprehensive delineation of white matter tract-related deformation.** *Journal of neurotrauma*
  Zhou, Z., Li, X., Liu, Y., Fahlstedt, M., Georgiadis, M., Zhan, X., Raymond, S. J., Grant, G., Kleiven, S., Camarillo, D. B., Zeineh, M.
  2021

- **Identifying Factors Associated with Head Impact Kinematics and Brain Strain in High School American Football via Instrumented Mouthguards.** *Annals of biomedical engineering*
  Cecchi, N. J., Domel, A. G., Liu, Y., Rice, E., Lu, R., Zhan, X., Zhou, Z., Raymond, S. J., Sami, S., Singh, H., Rangel, I., Watson, L. P., Kleiven, et al
  2021

- **Identifying Risk Factors For Head Impact Exposure In High School Football Using A Validated Instrumented Mouthguard**
  Cecchi, N. J., Domel, A. G., Liu, Y., Raymond, S. J., Zeineh, M., Camarillo, D., Grant, G.
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- **Altered sense of self during seizures in the posteromedial cortex.** *Proceedings of the National Academy of Sciences of the United States of America*
  Parvizi, J., Braga, R. M., Kucyi, A., Veit, M. J., Pinheiro-Chagas, P., Perry, C., Sava-Segal, C., Zeineh, M., van Staalduinen, E. K., Henderson, J. M., Markert, M.
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- **Predictive Factors of Kinematics in Traumatic Brain Injury from Head Impacts Based on Statistical Interpretation.** *Annals of biomedical engineering*
  Zhan, X., Li, Y., Liu, Y., Domel, A. G., Alizadeh, H. V., Zhou, Z., Cecchi, N. J., Raymond, S. J., Tiernan, S., Ruan, J., Barbat, S., Gevaert, O., Zeineh, et al
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- **Time Window of Head Impact Kinematics Measurement for Calculation of Brain Strain and Strain Rate in American Football.** *Annals of biomedical engineering*
  Liu, Y., Domel, A. G., Cecchi, N. J., Rice, E., Callan, A. A., Raymond, S. J., Zhou, Z., Zhan, X., Li, Y., Zeineh, M. M., Grant, G. A., Camarillo, D. B.
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- **Mammary Lobular Carcinoma-Like Salivary Gland Carcinoma: Report of a Rare Case.** *Head and neck pathology*
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- **Neuroimaging, Urinary, and Plasma Biomarkers of Treatment Response in Huntington's Disease: Preclinical Evidence with the p75NTR Ligand LM11A-31.** *Neurotherapeutics : the journal of the American Society for Experimental NeuroTherapeutics*
  Simmons, D. A., Mills, B. D., Butler Iii, R. R., Kuan, J., McHugh, T. L., Akers, C., Zhou, J., Syriani, W., Grouban, M., Zeineh, M., Longo, F. M.
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- **Correction to: Validation and Comparison of Instrumented Mouthguards for Measuring Head Kinematics and Assessing Brain Deformation in Football Impacts.** *Annals of biomedical engineering*
  Liu, Y., Domel, A. G., Yousefsani, S. A., Kondic, J., Grant, G., Zeineh, M., Camarillo, D. B.
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- **Validation and Comparison of Instrumented Mouthguards for Measuring Head Kinematics and Assessing Brain Deformation in Football Impacts (vol 48, pg 2580, 2020)** *ANNALS OF BIOMEDICAL ENGINEERING*
  Liu, Y., Domel, A. G., Yousefsani, S., Kondic, J., Grant, G., Zeineh, M., Camarillo, D. B.
  2021

- **High-resolution Structural Magnetic Resonance Imaging and Quantitative Susceptibility Mapping.** *Magnetic resonance imaging clinics of North America*
  Yedavalli, V., DiGiacomo, P., Tong, E., Zeineh, M.
  2021; 29 (1): 13–39

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  2021

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- **Rapid Estimation of Entire Brain Strain Using Deep Learning Models** *IEEE Transactions on Biomedical Engineering*
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- **Optimizing the Frame Duration for Data-Driven Rigid Motion Estimation in Brain PET Imaging.** *Medical physics*
  Spangler-Bickell, M. G., Hurley, S. A., Deller, T. W., Jansen, F. n., Bettinardi, V. n., Carlson, M. n., Zeineh, M. n., Zaharchuk, G. n., McMillan, A. B.
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