Daniel Jacob Tward, PhD

Assistant Professor, Departments of Computational Medicine and Neurology
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Education

The Johns Hopkins University School of Medicine, Baltimore, MD
PhD in Biomedical Engineering

2017

University of Toronto, Toronto, ON, Canada
HBSc in physics and physiology (dual specialization), conferred with high distinction

2008

Professional Experience

Assistant Professor, University of California Los Angeles,
Departments of Computational Medicine and Neurology, UCLA Brain Mapping Center

- Developing brain image analysis algorithms for basic neuroscience and disease understanding.

2020-

Assistant Research Professor, Johns Hopkins University,
Department of Biomedical Engineering

- Developed brain analysis and mapping techniques that cross spatial scales, for multiple species and image modalities, including serial sectioning, brain clearing (CLARITY/iDISCO), and synaptic labeling with sub micron resolution.

2019-20

Kavli Distinguished Postdoctoral Fellow mentored by Dr. Juan Troncoso (Department of Pathology) and Dr. Michael Miller (Department of Biomedical Engineering)
Johns Hopkins University, Kavli Neuroscience Discovery Institute

- Developed computational tools to connect longitudinal clinical human MR at millimeter scale to histopatholgy at micron scale, a crucial gap in our understanding of Alzheimer's progression and diagnosis.

2017-19

Graduate Research Assistant mentored by Dr. Michael Miller
Johns Hopkins University School of Medicine, Center for Imaging Science

- Designed parsimonious representations of anatomical variability in a Bayesian setting, and robust algorithms for computing structural imaging biomarkers of neurodegenerative disease.

2009-17

Research Assistant mentored by Dr. Jeffrey Siewerdsen
Image Guided Therapy Group, Department of Biophysics and Bioimaging, Ontario Cancer Institute, University Health Network

- Created and experimentally verified a theoretical model for image quality in 3D cone-beam computed tomography and tomosynthesis, using detector physics and human psychophysics.

2007-09

Summer Student mentored by Dr. Jeffrey Siewerdsen
Department of Medical Biophysics, University of Toronto

- Established low dose limits for adequate imaging performance in cone-beam computed tomography and dual energy radiography. Designed computational tools for evaluating image quality using human observer performance.

2005-06

Funding Awarded

BRAIN CONNECTS: Comprehensive regional projection map of marmoset with single axons and cell type resolution (subaward PI). NIH award number UM1 NS133283.   2023-28

XSEDE Research Grant for Computational Resources (co-I, 2,765,000 CPU hours, 7,500 GPU hours). "Computational Anatomy Gateway".   2022

Toolkit for Analysis and Visualization of Preclinical Rodent Neuroimaging Experiments (co-I). NIH award number R01 NS121761.   2022-27

Mapping Cellular Resolution Connectopathies in Aging and Alzheimer's Disease (co-I). NIH award number U01 AG076804.   2022-27

A 3D multimodal micron-scale human brain atlas bridging single cell data, neuropathology and neuroradiology (subaward PI). NIH award number RF1 MH128875.   2021-24

A Computational Framework for Distributed Registration of Massive Neuroscience Images (subaward PI). NIH award number RF1 MH126732.   2021-24

Platform technologies for scalable highly multiplexed proteomic phenotyping of the brain (co-I). NIH award number. RF1 MH128861   2021-24

Next-generation MORF Mice for Scalable Brainwide Morphological Mapping and Genetic Perturbation of Single Neurons (co-I). NIH award number RF1 MH128888.   2021-24

XSEDE Research Grant for Computational Resources (co-I, 1,995,000 CPU hours, 7,500 GPU hours). "Computational Anatomy Gateway".   2022

A comprehensive center for mouse brain cell atlas: data core (subaward PI). NIH award number U19 MH114821.   2021-22

BrainSuite: Software for Analysis and Visualization of Multimodal Brain Imaging Data (co-I). NIH award number R01 NS074980.   2021-22

XSEDE Research Grant for Computational Resources (co-I, 1,960,000 CPU hours, 35,000 GPU hours). "Computational Anatomy Gateway".   2021

XSEDE Research Grant for Computational Resources (PI, 4,413,600 CPU hours, 35,000 GPU hours). "Computational Anatomy Gateway".   2020

XSEDE Research Grant for Computational Resources (PI, 3,607,906 CPU hours, 50,000 GPU hours). "Computational Anatomy Gateway".   2019

XSEDE Research Grant for Computational Resources (PI, 3,856,160 CPU hours, 55,000 GPU hours). "Computational Anatomy Gateway".   2018

Kavli Neuroscience Discovery Institute Distinguished Postdoctoral Fellowship, "MR Micro Imaging and Three Dimensional Histology: Integrating Neuroimaging Data Across Scales."   2017-18

XSEDE Research Grant for Computational Resources (PI, 2,580,000 CPU hours). "Computational Anatomy Gateway".   2017

XSEDE Research Grant for Computational Resources (Co-PI, 2,823,800 CPU hours). "Computational Anatomy Gateway". 2016

XSEDE Research Grant for Computational Resources (Co-PI, 1,363,260 CPU hours). "Computational Anatomy Gateway" 2015

NSERC Doctoral Postgraduate Scholarship. Research funding from Natural Sciences and Engineering Research Council (NSERC) of Canada 2012-14

Julie Payette NSERC Research Scholarship. Masters-level research funding with distinction for scoring in the top 24 applications to NSERC of Canada 2010

Academic Honors

Toffler Scholar. The Toffler Scholar Program supports promising young medical researchers, physicians, and scientists who are at a pivotal point in their careers. 2021-22

Shape Special Interest Group Best Paper award. Judged best paper and presentation in Mathematical Foundations of Computational Anatomy at MICCAI conference 2019

XSEDE Best Lightning Talk. Judged best presentation in Lightning Talk session, a format for presenting top-scoring papers in each track conference-wide 2014

Farrington Daniels Award. Best paper on radiation dosimetry published in *Medical Physics* in 2012 2013

Johns Hopkins Imaging Initiative First Place Poster Award. Judged best poster at an institutional imaging conference 2013

Certificate Award of Excellence for Trainee Presentation. Judged best student talk at MITACS workshop of Mathematics of Brain Imaging 2012

The Prince Phillip Silver Medal. For achieving the second-highest GPA in the sciences in my graduating class 2008

The Scott Memorial Scholarship. Academic achievement upon graduating 2008

Summer Undergraduate Studentship, University of Toronto's Life Sciences Awards Committee. Exceptional performance as a summer student in medical biophysics 2006

University of Toronto Scholar. Academic achievement 2006

Professor William Kingston and Dr John Kingston Scholarship ($1000 CAD). Academic achievement 2006

Harold E. Johns Summer Studentship in Medical Physics Award ($4200 CAD). Exceptional performance as a summer student in medical physics 2005

McCutcheon Award. Academic achievement 2005

Induction into **Golden Key International Honor Society** 2005

Mrs. F. N. G. Starr Scholarship. Academic achievement 2004

Peer Reviewed Journal Publications

Note † indicates equal contribution between senior authors. * means graduate student and $^{+}$ means undergraduate student mentored by Daniel Tward.

1. G. Zhou[*], **D. J. Tward**, and K. Lange, "A majorization-minimization algorithm for neuroimage registration," *SIAM Journal on Imaging Sciences*, vol. 17, no. 1, pp. 273–300, 2024

2. R. He[*] and **D. J. Tward**, "Applying joint graph embedding to study alzheimer's neurodegeneration patterns in volumetric data," *Neuroinformatics*, pp. 1–14, 2023

3. B. Pang, S. Doshi, B. Roy, M. Lai, L. Ehlert, R. S. Aysola, D. W. Kang, A. Anderson, S. H. Joshi, **D. J. Tward**, F. Scalzo, S. Vacas, and R. Kumar, "Machine learning approach for obstructive sleep apnea screening using brain diffusion tensor imaging," *Journal of Sleep Research*, vol. 32, no. 1, e13729, 2023

4. K. M. Stouffer[*], C. Chen, S. Kulason, E. Xu, M. P. Witter, C. Ceritoglu, M. S. Albert, S. Mori, J. Troncoso, **D. J. Tward**, M. I. Miller, and for the Alzheimer's Neuroimaging Initiative, "Early amygdala and erc atrophy linked to 3d reconstruction of rostral neurofibrillary tau tangle pathology in alzheimer's disease," *NeuroImage: Clinical*, vol. 38, p. 103 374, 2023

5. M. J. Hawrylycz, M. E. Martone, P. R. Hof, E. S. Lein, A. Regev, G. A. A. Ascoli, J. G. Bjaalie, H.-W. Dong, S. S. Ghosh, J. Gillis, R. Hertzano, D. R. Haynor, Y. Kim, Y. Liu, J. A. Miller, P. P. Mitra, E. Mukamel, D. Osumi-Sutherland, H. Peng, P. L. Ray, R. Sanchez, A. Ropelewski, R. H. Scheuermann, S. Z. K. Tan, T. Tickle, H. Tilgner, M. Varghese, B. Wester, O. White, B. Aevermann, D. Allemang, S. Ament, T. L. Athey, P. M. Baker, C. Baker, K. S. Baker, A. Bandrowski, P. Bishwakarma, A. Carr, M. Chen, R. Choudhury, J. Cool, H. Creasy, F. D'Orazi, K. Degatano, B. Dichter, S.-L. Ding, T. Dolbeare, J. R. Ecker, R. Fang, J.-C. Fillion-Robin, T. P. Fliss, J. Gee, T. Gillespie, N. Gouwens, Y. O. Halchenko, N. Harris, B. R. Herb, H. Hintiryan, G. Hood, S. Horvath, D. Jarecka, S. Jiang, F. Khajouei, E. A. Kiernan, H. Kir, L. Kruse, C. Lee, B. Lelieveldt, Y. Li, H. Liu, A. Markuhar, J. Mathews, K. L. Mathews, M. I. Miller, T. Mollenkopf, S. Mufti, C. J. Mungall, L. Ng, J. Orvis, M. A. Puchades, L. Qu, J. P. Receveur, B. Ren, N. Sjoquist, B. Staats, C. L. Thompson, **D. J. Tward**, C. T. J. van Velthoven, Q. Wang, F. Xie, H. Xu, Z. Yao, Z. Yun, H. Zeng, G.-Q. Zhang, Y. R. Zhang, J. W. Zheng, and B. Zingg, "A guide to the brain initiative cell census network data ecosystem," *PLoS biology*, vol. 21, no. 6, e3002133, 2023

6. C. Caggiano, A. Boudaie, R. Shemirani, J. Mefford, E. Petter, A. Chiu, D. Ercelen, R. He, **D. J. Tward**, K. C. Paul, T. S. Chang, B. Pasaniuc, E. E. Kenny, J. A. Shortt, C. R. Gignoux, B. Balliu, V. A. Arboleda, G. Belbin, and N. Zaitlen, "Disease risk and healthcare utilization among ancestrally diverse groups in the los angeles region," *Nature Medicine*, vol. 29, no. 7, pp. 1845–1856, 2023

7. K. Clifton, M. Anant, G. Aihara, L. Atta, O. K. Aimiuwu[+], J. M. Kebschull, M. I. Miller, **D. J. Tward**†, and J. Fan†, "Stalign: Alignment of spatial transcriptomics data using diffeomorphic metric mapping," *Nature communications*, vol. 14, no. 1, p. 8123, 2023

8. J. Langlieb, N. S. Sachdev, K. S. Balderrama, N. M. Nadaf, M. Raj, E. Murray, J. T. Webber, C. Vanderburg, V. Gazestani, **D. J. Tward**, C. Mezias, X. Li, K. Flowers, D. M. Cable, T. Norton, P. Mitra, F. Chen, and E. Z. Macosko, "The molecular cytoarchitecture of the adult mouse brain," *Nature*, vol. 624, no. 7991, pp. 333–342, 2023

9. T. L. Athey, **D. J. Tward**, U. Mueller, L. Younes, J. T. Vogelstein, and M. I. Miller, "Preserving derivative information while transforming neuronal curves," *Neuroinformatics*, pp. 1–12, 2023

10. K. M. Stouffer*, M. P. Witter, **D. J. Tward**, and M. I. Miller, "Projective diffeomorphic mapping of molecular digital pathology with tissue mri," *Communications Engineering*, vol. 1, no. 1, p. 44, 2022

11. M. Miller, **D. J. Tward**, and A. Trouvé, "Molecular computational anatomy: Unifying the particle to tissue continuum via measure representations of the brain," *BME Frontiers*, 2022

12. T. L. Athey, **D. J. Tward**, U. Mueller, J. T. Vogelstein, and M. I. Miller, "Hidden markov modeling for maximum probability neuron reconstruction," *Communications Biology*, vol. 5, no. 1, pp. 1–11, 2022

13. J. T. Ratnanather, L. C. Wang, S.-H. Bae, E. R. O'Neill, E. Sagi, and **D. J. Tward**, "Visualization of speech perception analysis via phoneme alignment: A pilot study," *Frontiers in Neurology*, vol. 12, 2021

14. **D. J. Tward**, "An optical flow based left-invariant metric for natural gradient descent in affine image registration," *Frontiers in Applied Mathematics and Statistics*, vol. 7, p. 61, 2021, ISSN: 2297-4687. DOI: 10.3389/fams.2021.718607. [Online]. Available: `https://www.frontiersin.org/article/10.3389/fams.2021.718607`

15. A. R. Graves, R. H. Roth, H. L. Tan, Q. Zhu, A. M. Bygrave, E. Lopez-Ortega, I. Hong, A. C. Spiegel, R. C. Johnson, J. T. Vogelstein, **D. J. Tward**, M. I. Miller, and R. L. Huganir, "Visualizing synaptic plasticity in vivo by large-scale imaging of endogenous ampa receptors," *Elife*, vol. 10, e66809, 2021

16. T. L. Athey, J. Teneggi, J. T. Vogelstein, **D. J. Tward**, U. Mueller, and M. I. Miller, "Fitting splines to axonal arbors quantifies relationship between branch order and geometry," *Frontiers in Neuroinformatics*, vol. 15, p. 38, 2021, ISSN: 1662-5196. DOI: 10.3389/fninf.2021.704627. [Online]. Available: `https://www.frontiersin.org/article/10.3389/fninf.2021.704627`

17. V. Chandrashekhar*, **D. J. Tward**, D. Crowley, A. K. Crow, M. A. Wright, B. Y. Hsueh, F. Gore, T. A. Machado, A. Branch, J. S. Rosenblum, K. Deisseroth, and J. T. Vogelstein, "Cloudreg: Automatic terabyte-scale cross-modal brain volume registration," *Nature methods*, vol. 18, no. 8, pp. 845–846, 2021

18. T. L. Athey, C. Ceritoglu, **D. J. Tward**, K. S. Kutten, J. R. Depaulo, K. Glazer, F. S. Goes, J. R. Kelsoe, F. Mondimore, C. M. Nievergelt, K. Rootes-Murdy, P. P. Zandi, J. T. Ratnanather, and P. B. Mahon, "A 7 tesla amygdalar-hippocampal shape analysis of lithium response in bipolar disorder," *Frontiers in Psychiatry*, vol. 12, p. 99, 2021

19. **D. J. Tward**, T. Brown, Y. Kageyama, J. Patel, Z. Hou, S. Mori, M. Albert, J. Troncoso, and M. Miller, "Diffeomorphic registration with intensity transformation and missing data: Application to 3d digital pathology of alzheimer's disease," *Frontiers in neuroscience*, vol. 14, 2020

20. A. Jacob, **D. J. Tward**, S. Resnick, P. F. Smith, C. Lopez, E. Rebello, E. X. Wei, J. T. Ratnanather, and Y. Agrawal, "Vestibular function and cortical and sub-cortical alterations in an aging population," *Heliyon*, vol. 6, no. 8, e04728, Aug. 2020

21. S. Kulason, E. Xu, **D. J. Tward**, M. S. Albert, L. Younes, and M. I. Miller, "Entorhinal and transentorhinal atrophy in preclinical alzheimer's disease," *Frontiers in Neuroscience*, vol. 14, p. 804, Aug. 2020

22. A. S. Charles, B. Falk, N. Turner, T. D. Pereira, **D. J. Tward**, B. D. Pedigo, J. Chung, R. Burns, S. S. Ghosh, J. M. Kebschull, W. Silversmith, and J. T. Vogelstein, "Toward community-driven big open brain science: Open big data and tools for structure, function, and genetics," *Annual Review of Neuroscience*, vol. 43, 2020

23. **D. J. Tward**, P. Mitra, and M. Miller, "Estimating diffeomorphic mappings between templates and noisy data: Variance bounds on the estimated canonical volume form," *Quarterly of Applied Mathematics*, vol. 77, no. 2, pp. 467–488, 2019

24. S. Kulason, **D. J. Tward**, T. Brown, C. S. Sicat, C.-F. Liu, J. T. Ratnanather, L. Younes, A. Bakker, M. Gallagher, M. Albert, and M. I. Miller, "Cortical thickness atrophy in the transentorhinal cortex in mild cognitive impairment," *NeuroImage: Clinical*, p. 101 617, 2018

25. B. C. Lee, **D. J. Tward**, P. P. Mitra, and M. I. Miller, "On variational solutions for whole brain serial-section histology using the computational anatomy random orbit model," *PLOS Computational Biology*, vol. 14, no. 12, e1006610, 2018

26. J Vogelstein, E Perlman, B Falk, A Baden, W. G. Roncal, V Chandreshekhar, F Collman, S Seshamani, J Patsolic, K Lillaney, M Kazhdan, R. J. Hider, D Pryor, J Matelsky, A Crow, M Write, S Smith, T Gion, P Manavalan, B Wester, M Chevillet, E Trautman, K Khairy, E Bridgeford, D Kleissas, **D. J. Tward**, M Miller, R Vogelstein, K Deisseroth, and R Burns, "A community-developed open-source computational ecosystem for big neuro data," *Nature Methods*, Oct. 2018

27. M. I. Miller, S. Arguillère, **D. J. Tward**, and L. Younes, "Computational anatomy and diffeomorphometry: A dynamical systems model of neuroanatomy in the soft condensed matter continuum," *Wiley Interdisciplinary Reviews: Systems Biology and Medicine*, e1425, 2018

28. **D. J. Tward**, C. S. Sicat, T. Brown, A. Bakker, M. Gallagher, M. Albert, M. Miller, and for the Alzheimer's Disease Neuroimaging Initiative, "Entorhinal and transentorhinal atrophy in mild cognitive impairment using longitudinal diffeomorphometry," *Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring*, vol. 9, pp. 41–50, 2017

29. **D. J. Tward** and M. I. Miller, "On the complexity of human neuroanatomy at the millimeter morphome scale: Developing codes and characterizing entropy indexed to spatial scale," *Frontiers in Neuroscience*, vol. 11, p. 577, 2017

30. **D. J. Tward**, M. Miller, A. Trouve, and L. Younes, "Parametric surface diffeomorphometry for low dimensional embeddings of dense segmentations and imagery," *IEEE transactions on pattern analysis and machine intelligence*, vol. 39, no. 6, pp. 1195–1208, 2017

31. A. V. Faria, J. T. Ratnanather, **D. J. Tward**, D. S. Lee, F. Van Den Noort, D. Wu, T. Brown, H. Johnson, J. S. Paulsen, C. A. Ross, and L. Younes, "Linking white matter and deep gray matter alterations in premanifest huntington disease," *NeuroImage: Clinical*, vol. 11, pp. 450–460, 2016

32. W. Segars, H. Norris, G. M. Sturgeon, Y. Zhang, J. Bond, A. Minhas, **D. J. Tward**, J. Ratnanather, M. Miller, D Frush, and E Samei, "The development of a population of 4d pediatric xcat phantoms for imaging research and optimization," *Medical physics*, vol. 42, no. 8, pp. 4719–4726, 2015

33. M. I. Miller, J. T. Ratnanather, **D. J. Tward**, T. Brown, D. S. Lee, M. Ketcha, K. Mori, M.-C. Wang, S. Mori, M. S. Albert, L. Younes, and the BIOCARD research team, "Network neurodegeneration in alzheimer's disease via MRI based shape diffeomorphometry and high-field atlasing," *Frontiers in bioengineering and biotechnology*, vol. 3, 2015

34. P. B. Mahon, D. S. Lee, H. Trinh, **D. J. Tward**, M. I. Miller, L. Younes, P. E. Barta, and J. T. Ratnanather, "Morphometry of the amygdala in schizophrenia and psychotic bipolar disorder," *Schizophrenia research*, vol. 164, no. 1, pp. 199–202, 2015

35. M. I. Miller, L. Younes, J. T. Ratnanather, T. Brown, H. Trinh, D. S. Lee, **D. J. Tward**, P. B. Mahon, S. Mori, M. Albert, and the BIOCARD research team, "Amygdalar atrophy in symptomatic alzheimer's disease based on diffeomorphometry: The BIOCARD cohort," *Neurobiology of aging*, vol. 36, S3–S10, 2015

36. H. Norris, Y. Zhang, J. Bond, G. M. Sturgeon, A. Minhas, **D. J. Tward**, J. Ratnanather, M. Miller, D Frush, E Samei, and W. Segars, "A set of 4d pediatric xcat reference phantoms for multimodality research," *Medical physics*, vol. 41, no. 3, 2014

37. **D. J. Tward**, J. Ma, M. I. Miller, and L. Younes, "Robust diffeomorphic mapping via geodesically controlled active shapes," *Journal of Biomedical Imaging*, vol. 2013, p. 3, 2013

38. W. Segars, J. Bond, J. Frush, S. Hon, C. Eckersley, C. H. Williams, J. Feng, **D. J. Tward**, J. Ratnanather, M. Miller, D Frush, and E Samei, "Population of anatomically variable 4d xcat adult phantoms for imaging research and optimization," *Medical physics*, vol. 40, no. 4, 2013

39. A. R. Pineda, **D. J. Tward**, A. Gonzalez, and J. H. Siewerdsen, "Beyond noise power in 3d computed tomography: The local nps and off-diagonal elements of the fourier domain covariance matrix," *Medical physics*, vol. 39, no. 6, pp. 3240–3252, 2012

40. X. Li, E. Samei, C. H. Williams, W. P. Segars, **D. J. Tward**, M. I. Miller, J. T. Ratnanather, E. K. Paulson, and D. P. Frush, "Effects of protocol and obesity on dose conversion factors in adult body CT," *Medical physics*, vol. 39, no. 11, pp. 6550–6571, 2012

41. **D. J. Tward**, C. Ceritoglu, A. Kolasny, G. M. Sturgeon, W. P. Segars, M. I. Miller, and J. T. Ratnanather, "Patient specific dosimetry phantoms using multichannel lddmm of the whole body," *Journal of Biomedical Imaging*, vol. 2011, p. 3, 2011

42. G. J. Gang, J. Lee, J. W. Stayman, **D. J. Tward**, W Zbijewski, J. L. Prince, and J. H. Siewerdsen, "Analysis of fourier-domain task-based detectability index in tomosynthesis and cone-beam CT in relation to human observer performance," *Medical physics*, vol. 38, no. 4, pp. 1754–1768, 2011

43. G. Gang, **D. J. Tward**, J Lee, and J. Siewerdsen, "Anatomical background and generalized detectability in tomosynthesis and cone-beam CT," *Medical physics*, vol. 37, no. 5, pp. 1948–1965, 2010

44. **D. J. Tward** and J. H. Siewerdsen, "Noise aliasing and the 3d neq of flat-panel cone-beam CT: Effect of 2d/3d apertures and sampling," *Medical physics*, vol. 36, no. 8, pp. 3830–3843, 2009

45. **D. J. Tward** and J. H. Siewerdsen, "Cascaded systems analysis of the 3d noise transfer characteristics of flat-panel cone-beam CT," *Medical physics*, vol. 35, no. 12, pp. 5510–5529, 2008

46. **D. J. Tward**, J. Siewerdsen, M. Daly, S Richard, D. Moseley, D. Jaffray, and N. Paul, "Soft-tissue detectability in cone-beam ct: Evaluation by 2afc tests in relation to physical performance metrics," *Medical physics*, vol. 34, no. 11, pp. 4459–4471, 2007

47. D. Williams, J. Siewerdsen, **D. J. Tward**, N. Paul, A. Dhanantwari, N. Shkumat, S Richard, J Yorkston, and R Van Metter, "Optimal kvp selection for dual-energy imaging of the chest: Evaluation by task-specific observer preference tests," *Medical physics*, vol. 34, no. 10, pp. 3916–3925, 2007

Manuscripts under review and preprints

1. R. He* and **D. J. Tward**, "Individualized multi-horizon mri trajectory prediction model for alzheimer's disease," in *MICCAI 2024*, under review, 2024

2. **D. J. Tward**, B. D. P. Gray*, X. Li, B. Huo, S. Banarjee, S. Savoia, C. Mezias, S. Das, M. Miller, and P. P. Mitra, "Solving the where problem and quantifying geometric variation in neuroanatomy using generative diffeomorphic mapping," *Nature Communications*, 2024, Under review.

3. A. Branch, **D. J. Tward**, A. C. Kolstad, V. Pulyadi, J. T. Vogelstein, Z. Wu, and M. Gallagher, "An optimized tissue clearing protocol for rat brain labeling, imaging, and high throughput analysis," *bioRxiv*, p. 639 674, 2021

4. **D. J. Tward** and M. Miller, "EM-LDDMM for 3d to 2d registration," *BioRxiv*, p. 604 405, 2019, preprint

5. G. Kiar, R. J. Anderson, A. Baden, A. Badea, E. W. Bridgeford, A. Champion, V. Chandrashekhar, F. Collman, B. Duderstadt, A. C. Evans, F. Engert, B. Falk, T. Glatard, W. R. G. Roncal, D. N. Kennedy, J. Maitin-Shepard, R. A. Marren, O. Nnaemeka, E. Perlman, S. Seshamani, E. T. Trautman, **D. J. Tward**, P. A. Valdes-Sosa, Q. Wang, M. I. Miller, R. Burns, and J. T. Vogelstein, "Neurostorm: Accelerating brain science discovery in the cloud," *arXiv preprint arXiv:1803.03367*, 2018

Peer Reviewed Conference Proceedings

1. K. M. Stouffer*, Z. Wang, E. Xu, K. Lee, P. Lee, M. I. Miller, and **D. J. Tward**, "From picoscale pathology to decascale disease: Image registration with a scattering transform and varifolds for manipulating multiscale data," in *International Workshop on Multimodal Learning for Clinical Decision Support*, Springer, 2021, pp. 1–11

2. M. I. Miller, J. Fan, and **D. J. Tward**, "Multi scale diffeomorphic metric mapping of spatial transcriptomics datasets," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 2021, pp. 4472–4480

3. M. I. Miller, **D. J. Tward**, and A. Trouve, "Coarse-to-fine hamiltonian dynamics of hierarchical flows in computational anatomy," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops*, 2020, pp. 860–861

4. B. C. Lee, **D. J. Tward**, Z. Hu, A. Trouve, and M. I. Miller, "Infinitesimal drift diffeomorphometry models for population shape analysis," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops*, 2020, pp. 862–863

5. **D. J. Tward**, X. Li, B. Huo, B. Lee, P. Mitra, and M. Miller, "3d mapping of serial histology sections with anomalies using a novel robust deformable registration algorithm," in *Multimodal Brain Image Analysis and Mathematical Foundations of Computational Anatomy*, Winner of 2020 MICCAI Shape Special Interest Group Best Paper Award, Springer, 2019, pp. 162–173

6. **D. J. Tward**, A. Kolasny, F. Khan, J. Troncoso, and M. Miller, "Expanding the computational anatomy gateway from clinical imaging to basic neuroscience research," in *Proceedings of the Practice and Experience in Advanced Research Computing on Rise of the Machines (learning)*, ACM, 2019, p. 9

7. B. C. Lee, **D. J. Tward**, J. Wei, D. Tipre, R. G. Weiss, M. I. Miller, and S. Ardekani, "Diffeomorphic upsampling of serially acquired sparse 2d cross-sections in cardiac mri," in *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, IEEE, 2019, pp. 4491–4495

8. **D. J. Tward**, M. Miller, and for the Alzheimer's Disease Neuroimaging Initiative, "Unbiased diffeomorphic mapping of longitudinal data with simultaneous subject specific template estimation," in *Graphs in Biomedical Image Analysis, Computational Anatomy and Imaging Genetics*, Springer, Cham, 2017, pp. 125–136

9. **D. J. Tward**, B. Lee, P. Mitra, and M. I. Miller, "Performance of image matching in the computational anatomy gateway: CPU and GPU implementations in OpenCL," in *Proceedings of the Practice and Experience in Advanced Research Computing 2017 on Sustainability, Success and Impact*, ACM, 2017, p. 46

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2. **D. J. Tward**, "Familywise error rate control for statistical testing in brain image ontologies," in *Computational Genomics Summer Institute 2023*, Computational Genomics Summer Institute 2023, 2023

3. **D. J. Tward**, "Atlas mapping methods for quantifying age related brain morphology and cell density," in *BICCN Developing Brain Atlas Working Group*, BICCN Developing Brain Atlas WG, 2022

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5. **D. J. Tward**, "Identifying structural changes in the brain specific to early alzheimer's disease," in *World Congress of Society for Brain Mapping and Therapeutics*, 2021