

Brian T. Castle

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EDUCATION:

- Ph.D. Biomedical Engineering** August 2014
University of Minnesota-Twin Cities Minneapolis, MN
Thesis title: *"Multiscale Modeling and Analysis of Microtubule Self-assembly Dynamics."*
- B.A. Biology, Cum laude** May 2008
Gustavus Adolphus College Saint Peter, MN

RESEARCH AND TRAINING EXPERIENCE:

Researcher 5 2017-2021
Department of Biomedical Engineering, University of Minnesota-Twin Cities Minneapolis, MN
Adviser: David J. Odde, Ph.D.

- Developed, validated, and tested an original computational model for the SARS-CoV-2 viral cycle, the results of which inspired a phase 3 clinical trial at the University of Minnesota
- Managed functionality and performance of microscope systems, served as laboratory expert in microscope specifications and capabilities, and trained lab personnel in microscopy techniques
- Collaborated with researchers at University of Michigan, University of Pennsylvania, and University of Minnesota to advance NIH funded research projects

Postdoctoral Research Associate 2014-Present
Department of Biomedical Engineering, University of Minnesota-Twin Cities Minneapolis, MN
Advisers: David J. Odde, Ph.D. and David K. Wood, Ph.D.

- Designed new methodology for quantitative analysis of sickle hemoglobin fiber assembly
- Developed and implemented policies for resource and data sharing for the NIH funded Center for Modeling Tumor Cell Migration Mechanics at the University of Minnesota
- Tested Sigma-Aldrich's Beta software for lab organization

Graduate Research Assistant 2008-2014
Department of Biomedical Engineering, University of Minnesota – Twin Cities Minneapolis, MN
Adviser: David J. Odde, Ph.D.
Project: *"Microtubule dynamics at the nanoscale"*

- Mentored four undergraduate students and one masters student working on independent research projects, three of which resulted in or contributed to journal publications
- Integrated quantitative microscopy and stochastic computational modeling to investigate the functional mechanisms of microtubule-directed chemotherapeutics
- Developed, tested, and validated two original algorithms for simulating protein-protein interactions
- Expanded the functionality of a semi-automated algorithm for tracking fluorescence signal profiles as well as improved algorithm performance and usability
- Directed the addition of two laboratory microscopes including research, demos, purchase, setup, and training

NIH Neuroimaging Training Fellowship 2008-2010
University of Minnesota – Twin Cities Minneapolis, MN
Adviser: David J. Odde, Ph.D.

- Co-adviser: Timothy J. Ebner, M.D., Ph.D.
Project: *"Single microtubule imaging in synaptically-competent neurons"*
- Advanced research characterizing microtubule assembly dynamics in differentiated neurons

- Completed supplemental training in neuroimaging techniques including fMRI, EEG, and two-photon confocal microscopy
- Selected as program representative to attend NIH Grantees Meeting

ARTICLES:

1. **Castle, B.T.**, K.M. McKibben, E. Rhoades, and D.J. Odde. 2020. Tau avoids the GTP at growing microtubule plus-ends. *iScience*. Vol. 23, 101782.
2. Hemmat, M., **B.T. Castle**, J.N. Sachs, and D.J. Odde. 2019. Multiscale computational modeling of tubulin-tubulin lateral interaction. *Biophysical Journal*. Vol. 117, pp. 1234-1249.
3. **Castle, B.T.**, D.J. Odde, and D.K. Wood. 2019. Rapid kinetics of sickle hemoglobin self-assembly. *Science Advances*. Vol. 13, eea1086.
4. Cong H., X. Zhao, **B.T. Castle**, E.J. Pomeroy, B. Zhou, J. Lee, Y. Wang, T. Bian, Z. Miao, W. Zhang, Y.Y. Sham, D.J. Odde, C.E. Eckfeldt, C. Xing, and C. Zhuang. 2018. An indole-chalcone inhibits multidrug-resistant cancer cell growth by targeting microtubules. *Molecular Pharmaceutics*. Vol. 15, pp. 3892-3900.
5. **Castle, B.T.**, S. McCubbin, L.S. Prah, J.N. Bernens, D. Sept, and D.J. Odde. 2017. Mechanisms of kinetic stabilization by the drugs paclitaxel and vinblastine. *Molecular Biology of the Cell*. Vol. 28, mbc.E16-08-0567
6. Powers, J.D., **B.T. Castle**, and D.J. Odde. 2015. The predicted role of steric specificity in crowding-mediated effects on reversible biomolecular association. *Physical Biology*. Vol. 12, pp. 066004.
7. **Castle, B.T.*** and D.J. Odde. 2013. Brownian dynamics of subunit addition-loss kinetics in linear polymer self-assembly. *Biophysical Journal*. Vol. 105, pp. 2528-40.
*Designed original artwork chosen for the cover of the journal issue, artwork additionally featured on the cover of *Biophysical Journal's* "Best of 2013" issue.
8. Seetapun, D., **B.T. Castle**, A.J. McIntyre, P.T. Tran, and D.J. Odde. 2012. Estimating the microtubule GTP cap size *in vivo*. *Current Biology*. Vol. 22, pp. 1681-7.
9. **Castle, B.T.**, S.A. Howard, and D.J. Odde. 2011. Assessment of transport mechanisms underlying the bicoid morphogen gradient. *Cellular and Molecular Bioengineering*. Vol. 4, pp. 116-121.

INVITED PUBLICATIONS AND BOOK CHAPTERS:

1. Hemmat, M., **B.T. Castle**, and D.J. Odde. 2018. "Microtubule dynamics: moving toward a multi-scale approach." *Current Opinion in Cell Biology*. Vol. 50, pp. 8-13
2. **Castle, B.T.** and D.J. Odde. 2016. "Dynamics of Microtubule Self-assembly." in *Encyclopedia of Cell Biology*, Academic Press, Ralph A. Bradshaw and Philip D. Stahl eds. Vol. 4, pp. 36-43
3. **Castle, B.T.** and D.J. Odde. 2015. "Optical control of microtubule dynamics in time and space." *Cell*. Vol. 162, pp. 243-245.
4. Prah L.S., **B.T. Castle**, M.K. Gardner, and D.J. Odde. 2014. "Quantitative analysis of microtubule self-assembly kinetics and tip structure" in *Methods in Enzymology*, Elsevier, Ron Vale ed. Vol. 540, pp. 35-52.

INVITED ORAL PRESENTATIONS:

1. "Multiscale Modeling and Analysis in the Study of Microtubule Self-assembly Dynamics." *Medtronic Neuromodulation Group: Visiting Scholar*. May 19, 2015. Minneapolis, MN.
2. "Cellular Polymer Tracking using Digital Fluorescence Microscopy: Probing the Spatial and Temporal Limits." *Minnesota Microscopy Society Annual Spring Symposium*. May 1, 2015. Saint Paul, MN.
3. "Brownian Dynamics of Subunit Kinetics and Thermodynamics in Linear Polymer Self-assembly." *University of Minnesota Cytoskeleton Club*. June 28, 2013. Minneapolis, MN.

CONFERENCE ABSTRACTS:

1. **B.T. Castle** and D.J. Odde. "Cell Migration Simulator (CMS) for Investigating and Predicting Tumor Cell Migration." *Physical Sciences in Oncology Network – Annual Investigators Meeting*. Boston, MA, 17-19 October, 2017.
2. **B.T. Castle**, S. McCubbin, L.S. Prah, J.N. Bernens, D. Sept and D.J. Odde. "Mechanisms of Kinetic Stabilization by the Drugs Paclitaxel and Vinblastine." *American Society for Cell Biology Annual Meeting*. San Francisco, CA, 3-7 December, 2016.
3. **B.T. Castle**, S. McCubbin, L.S. Prah, J.N. Bernens, D. Sept and D.J. Odde. "Requirements for Dynamic Instability and the Mechanisms of Microtubule-targeting Agents." *Biomedical Engineering Society Annual Meeting*. Tampa, FL, 7-10 October, 2015.
4. **B.T. Castle**, L.S. Prah, J.N. Bernens, and D.J. Odde. "Requirements for dynamic instability and the mechanisms of microtubule-targeting agents." *Mathematics of the Cell: Integrating Genes, Biochemistry, and Mechanics*. Banff International Research Station, Banff, AB, 7-12 September, 2014.
5. **B.T. Castle** and D.J. Odde. "Brownian Dynamics of Subunit Kinetics and Thermodynamics in Linear Polymer Self-Assembly." *American Society for Cell Biology Annual Meeting*. New Orleans, LA, 14-18 December, 2013.
6. L.S. Prah, **B.T. Castle**, J.N. Bernens and D.J. Odde. "Evaluating Mechanisms of Microtubule Dynamics Suppression by Paclitaxel and Vinblastine." *American Society for Cell Biology Annual Meeting*. New Orleans, LA, 14-18 December, 2013.
7. S.K. Tang, **B.T. Castle**, and D.J. Odde. "Monte Carlo Simulation of Centrosomal Self-centering due to Pushing by Microtubules in Large Cells." *American Society for Cell Biology Annual Meeting*. Denver, CO, 3-7 December, 2011.
 - Work completed during the Physiology course at the Marine Biological Laboratory in Woods Hole, MA
8. **B.T. Castle**, J. Bernens, and D.J. Odde. "Microtubule Assembly Dynamics In Vivo in the Presence of Taxol: from the nanoscale to the microscale." *Biomedical Engineering Society Annual Meeting*. Hartford, CT, 12-15 October, 2011.
9. **B.T. Castle** and D.J. Odde, "Single Microtubule Imaging in Synaptically Competent Neurons and U251 Glioma Cells." *NIH Grantees Meeting*. National Institutes of Health, Bethesda, MD, 23-25 June, 2010.
10. **B.T. Castle**, D. Seetapun, and D.J. Odde, "A Cell-length-dependent Model for Microtubule Plus-end Distributions in Mature Neurons." *European Molecular Biology Organization (EMBO) - Microtubules: Structure, Regulation, and Function*. European Molecular Biology Laboratory, Heidelberg, Germany, 2-5 June, 2010.
11. D. Seetapun, **B.T. Castle**, and D.J. Odde, "Cell-length-dependent Microtubule Accumulation During Polarization." *American Society for Cell Biology Annual Meeting*. San Diego, CA, 4-9 December, 2009.
12. **B.T. Castle**, S.A. Howard, and D.J. Odde. "Assessment of Transport Mechanisms Underlying the Bicoid Morphogen Gradient." *Gordon Research Conference: Motile and Contractile Systems*. New London, NH, 12-17 July, 2009.

MANUSCRIPT REVIEWS:

PLoS Computational Biology

Journal of Microscopy

Biophysical Journal

International Journal of Molecular Science

Physical Review Letters

Physical Review E

ELife

PLoS Biology

Nature Reviews – Molecular Cell Biology

FELLOWSHIPS AND AWARDS:

2004-2012 Marshall H. and Nellie Alworth Memorial Scholar

2008-2010 NIH Neuroimaging Training Fellowship

2008-2009 Boston Scientific Graduate Fellow

TEACHING EXPERIENCE:

Teaching Assistant, Programming for Biomedical Engineers September-December 2012
Department of Biomedical Engineering, University of Minnesota – Twin Cities Minneapolis, MN

Teaching Assistant, Physiology: Modern cell biology using microscopic, biochemical, and computational approaches July 2010-2012
Marine Biological Laboratory Woods Hole, MA

- Tutored advanced graduate students and postdoctoral fellows to develop skills in computational modeling of biological systems and to apply them to their own research projects

Teaching Assistant, Cell Engineering September-December 2009
Department of Biomedical Engineering, University of Minnesota – Twin Cities Minneapolis, MN