



David Umulis
Ph.D. University of Minnesota - 2007

Associate Professor

Research Areas:

Systems biology, bioengineering, finite element method, Bone Morphogenic Proteins, TGF-beta

Selected Publications (last 5 years):

1. **Umulis DM.** Analysis of dynamic morphogen scale-invariance. *Journal of the Royal Society:Interface.* 6:1179-1191. (2009).
2. **Umulis DM,** O'Connor MB, Blair SS. The extracellular regulation of Bone Morphogenetic Protein signaling. *Development* (2009). (Top 10 most downloaded paper for November 2009)
3. **Umulis DM,** O. Shimmi, O'Connor MB, Othmer HG. Organism-scale modeling of early Drosophila patterning via bone morphogenetic proteins. *Developmental Cell*, 18:260-274 (2010).
4. **SOM: 27 pgs. (Featured on F1000 Biology;** top-20 most accessed paper February 2010).
5. Robin E. Harris, Michael Pargett, Catherine Sutcliffe, **Umulis DM,** Hilary L. Ashe. Brat promotes stem cell differentiation via control of a bistable switch that restricts BMP signaling. *Developmental Cell.* 18:72-83 (2011) and **SOM;** top-10 most accessed paper at *Dev. Cell* February 2011).
6. Carolyn E. Peluso, **Umulis DM,** Young-Jun Kim, Michael B. O'Connor and Mihaela Serpe. Shaping BMP morphogen gradients through enzyme-substrate interactions. *Developmental Cell.* 21:375-383 (2011). (Developmental Cell "Feature article", top 20 accessed article August 2011).
7. Hengenus JB, Gribskov M, Rundell AE, Fowlkes CC, and **Umulis DM.** Analysis of Gap Gene regulation in an Organism-scale model of the Drosophila melanogaster Embryo. *PLoS ONE* 6(11), e26797.
8. Karim MS, Buzzard G, and **Umulis DM.** Secreted, receptor-associated BMP regulators reduce stochastic noise intrinsic to many extracellular morphogen distributions. *Journal of the Royal Society Interface*, 9:1073-1083 (2012)
9. Claussen JC, Hengenus J, Wickner MM, Fisher TS, **Umulis DM***, Porterfield DM*. Effects of Carbon Nanotube-Tethered Nanosphere Density on Amperometric Biosensing: Simulation and Experiment. *J. Phys. Chem. C*, 115(43):20896:20904 (2011).
10. Wang HW, Chai N, Hu S, Dou W, **Umulis DM,** Wang LV, Sturek M, Lucht R, Cheng JX. Label-free bond selective imaging by listening to vibrationally excited molecules. *Phys. Rev. Lett.* 106:238106 (2011)
11. A Brooks, W Dou, X Yang, T Brosnan, M Pargett, LA Raftery, **DM Umulis.** BMP signaling in wing development: a critical perspective on quantitative image analysis. *FEBS Letters* 586: 1942-1952. (2012).
12. LA Raftery, **Umulis DM.** Regulation of BMP activity and range in Drosophila wing development. *Current Opinion in Cell Biology*, 24(2):158-165. (2012).
13. W Dou, D Zhang, Y Jung, JX Cheng, **Umulis DM.** Label-Free Imaging of Lipid-Droplet Intracellular Motion in Early Drosophila Embryos Using Femtosecond-Stimulated Raman Loss Microscopy. *Biophysical Journal.* 102 (7), 1666-1675. (2012). **Selected as a featured article.**
14. Pargett M, **Umulis DM.** Evaluation of Quantitative approaches to optimizing models with Qualitative data. *Elsevier Methods.* 62 (1):56-67.
15. Karim M, Buzzard GT, **Umulis DM.** Steady-state probability approximation improves the efficiency of numerical calculation of stochastic reaction networks. *BMC Genomics* 13:S10, (2012).
16. **Umulis DM** and Othmer HG. (Co-corresponding authors). The importance of geometry in mathematical models of developing systems. *Current Opinion in Genetics and Development*, 22:547-552. (2012).
17. Hengenus J, Gribskov M, Rundell A, and **Umulis DM.** Making models match measurements: Model optimization for morphogen signaling networks. (2014) *Seminars in Developmental Biology*).
18. **Umulis DM** and Othmer HG. Mechanisms of Scaling in pattern formation. *Development* 140 (24):4830-4843.
19. Michael Pargett, Rundell A, Buzzard G, and **Umulis DM.** Model-based identification of germline-stem cell regulation. (2014). *PLOS Computational Biology* 10 (3), e1003498.
20. **Umulis DM** and Othmer HG. The role of mathematical models in understanding pattern formation in developmental biology. (2014) *Bulletin of Mathematical Biology.*

Selected Conference Presentations (last 5 years):

1. **Umulis DM.** June 2009. Invited seminar. Indian Institute of Science Education and Research (IISER), Pune, India.
2. **Umulis DM.** June 2009. Advances in Chemical Engineering and Process Technology. National Chemical Laboratories, Pune, India.
3. **Umulis DM.** June 2009. Workshop: Drosophila Development. Ohio State University, Columbus, OH.
4. **Umulis DM.** June 2009. 2009 FASEB meeting on TGF- β Signaling in Development and Disease. Carefree, AZ.
5. Michael Pargett, James Hengenus, Sang-Hun Lee, Shahriar Karim, and **Umulis DM.** Systems biology of tissue patterning: insights from Drosophila embryos, Zebrafish embryos, and the Drosophila germline. SIAM great lakes. April 17, 2010.
6. Michael Pargett, Robin E. Harris, Hilary L. Ashe, **Umulis DM,** Systems biology of spatial organization: Autoregulation and competition in BMP-mediated patterning. Society for Developmental Biology and Japanese Society for Developmental Biology 69th annual meeting. Albuquerque, New Mexico. August 5-8, 2010.
7. **Umulis DM.** Future directions: Mathematical modeling of stem cell regulation. Joint NIH/FDA meeting on Pluripotent Stem Cells in Translation: Early Decisions. (Invited by Christine Kelley, Division Director for NIBIB at NIH). Bethesda, MD. March 2011.
8. **Umulis DM.** Inference of Bone Morphogenetic Protein regulation by image-based model development and optimization against diverse data. National Institute of Health: Child Health and Development. March 2011.
9. **Umulis DM.** Dynamic simulation of Bone Morphogenetic Protein Patterning in a 3D model of the zebrafish embryo. Comsol Conference 2011 Boston. Session Chair and Invited Seminar October 2011.
10. **Umulis DM.** Model-based network identification of Drosophila germline stem cell regulation mechanisms. Invited presentation in bistability workshop at the 54th Annual Drosophila research conference. April 2013.

