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Sarah Dianne Olson

CURRENT POSITION

Worcester Polytechnic Institute

Assistant Professor, Department of Mathematical Sciences, July 2011 - present

PROFESSIONAL EXPERIENCE

Tulane University

NSF VIGRE Postdoctoral Fellow, Department of Mathematics, July 2008 – June 2011
Mentor: Lisa Fauci

North Carolina State University

NSF RTG Research Fellow, Department of Mathematics, 2007- 2008
Research Assistant, Department of Mathematics, 2006- 2007
Teaching Assistant, Department of Mathematics, 2005- 2006
Advisor: Mansoor Haider

University of Rhode Island

Teaching Assistant, Department of Mathematics, 2003-2005

Roger Williams Medical Center

Research Technician, Cancer Immunotherapy Research Laboratory, 2002-2004
Director: Lawrence Lum

EDUCATION

Ph.D. *Biomathematics,* North Carolina State University, 2008
M.S. *Mathematics,* University of Rhode Island, 2005
B.A. *Mathematics,* Providence College, 2003
B.A. *Biology,* Providence College, 2003

RESEARCH INTERESTS

Mathematical biology, biological fluid dynamics, biomechanics, calcium signaling, and scientific computing.

AWARDS

- AWM Travel Grant Award to attend Annual Meeting of the Society of Mathematical Biology joint with the European Society of Mathematical and Theoretical Biology in Krakow, Poland, Summer 2011
- SMB Travel Grant Award to attend Casablanca International Workshop in Mathematical Biology, Summer 2011
- Lucas Research Award, Biomathematics Graduate Program, North Carolina State University, May 2009

- 2nd place poster presentation at the Graduate Student Research Symposium, North Carolina State University, March 2008
- Lucas Outstanding Service Award, Biomathematics Graduate Program, North Carolina State University, May 2006

RESEARCH FUNDING

Mechanisms of invertebrate sperm chemotaxis: from cellular signaling to flagellar swimming. National Science Foundation, Division of Mathematical Sciences, Mathematical Biology Program. (2011 - 2014)

TEACHING EXPERIENCE (Primary Instructor)

- *Calculus IV*
  - Worcester Polytechnic Institute MA1024, B term 2011
- *Calculus III*
  - Worcester Polytechnic Institute MA1023: A term 2011, C term 2012
- *Differential Equations & Boundary Value Problems*,
  - Tulane University MA 4240/6240: Fall 2008, Spring 2010, Fall 2010
- *Introduction to Scientific Computing*
  - Tulane University MA 3310/6310: Spring 2009, Spring 2011
- *Consolidated Calculus*
  - Tulane University MA 1310: Fall 2009
- *Applied Calculus I*
  - University of Rhode Island MTH 131: Spring 2005
- *Precalculus*
  - North Carolina State University MA 111: Spring 2006
  - University of Rhode Island MTH 111: Fall 2003, Spring 2004, Fall 2004
- *Topics in Contemporary Mathematics*
  - North Carolina State University MA 103: Fall 2005

MENTORING, SERVICE, AND COMMITTEES

- Senior Project, Tulane University, Spring 2010
  - Title: *Models Forecasting NCAA Basketball Results*
- PhD Thesis Committee Member: Charles Maggio, Tulane University, 2011
- Referee for: Mathematical Biosciences, Journal of Biomechanical Engineering, Bulletin of Mathematical Biology, The Biological Bulletin
- WPI Mathematical Sciences Colloquium co-organizer, Fall 2011 – present
- Mini-symposiums:
  - "*Biolocomotion*" at SIAM Life Sciences 2012 (with S. Lim)
  - "*Modeling in Biomechanics and Bioengineering"* at SIAM Southeastern – Atlantic Section Conference

PUBLICATIONS

Submitted

- [2012] **Olson SD,** Lim S, Cortez R. Modeling the dynamics of an elastic rod with intrinsic curvature and twist using a regularized Stokes formulation. Submitted January 2012.

Peer-Reviewed Articles

- [2011] **Olson SD,** Suarez SS, Fauci LJ. Coupling biochemistry and hydrodynamics captures hyperactivated sperm motility in a simple flagellar model. *Journal of Theoretical Biology*, Vol. 283, pp. 203-216.
- [2011] **Olson SD**, Fauci LJ, Suarez SS. Mathematical analysis of sperm hyperactivation and calcium signaling. Sperm Motility Themed Issue in: *New Research Horizon Reviews in Molecular Human Reproduction* (Invited), Vol. 17, pp. 500-510.
- [2010] **Olson SD**, Suarez SS, Fauci LJ. A model of CatSper channel mediated Ca^{2+} dynamics in mammalian spermatozoa. *Bulletin of Mathematical Biology*, Vol. 72, pp. 1925-1946.
- [2009] **Olson SD** and Haider MA, A level set reaction-diffusion model for tissue regeneration in a cartilage-hydrogel aggregate, *International Journal of Pure and Applied Mathematics*, Vol. 53, pp. 333-353.
- [2008] **Olson SD**, Mathematical models for analysis of tissue regeneration, Dissertation, North Carolina State University.
- [2006] Grabert RC, Cousens LP, Smith JA, **Olson SD**, Gall J, Young WB, Davol PA, Lum LG. Human T cells armed with Her2/neu bispecific antibodies divide, are cytotoxic, and secrete cytokines with repeated stimulation. *Clinical Cancer Research*, Vol. 12(2), pp. 569-576.
- [2006] Reusch U, Sundaram M, Davol PA, **Olson SD**, Davis JB, Demel K, Nissim J, Rathore R, Liu PY, Lum LG. Anti-CD3 x anti-epidermal growth factor receptor (EGFR) bispecific antibody redirects T-cell cytolytic activity to EGFR-positive cancers in vitro and in an animal model. *Clinical Cancer Research,* Vol. 12(1), pp. 183-90.

Technical Reports

- [2007] Chen T, Dixit A, Ho C, Li Y, **Olson SD**, Reale-Levis J. "Modeling probability of drinking water contamination," *Proceedings of the Thirteenth Industrial Mathematical and Statistical Modeling Workshop for Graduate Students,* pp. 47-58. Industrial Representative: Michael Messner, EPA, Faculty Mentor: Mette Olufsen.

Abstracts

- [2006] Davol PA, Gall JM, **Olson SD**, Rathore R, Lum LG. Abciximab (ReoPro), an antithrombotic agent, effectively redirects the cytolytic activity of ATC to target AML via BiAb technology. *Experimental Hematology,* Vol. 34(9), 68 130T5 Suppl. 1.
- [2005] Reusch U, **Olson SD**, Davis J, Davol P, Sundarum M, Liu P, Lum LG. T-cell based cancer immunotherapy with a bispecific antibody directed at CD3 and EGFR. *J Clinical Oncology,* Vol. 23(16), 178S Part 1 Suppl. S.
- [2003] Davol PA, Gall J, **Olson SD**, Grabert RC, Kouttab NM, Lum LG. Trafficking and clinical responses in SCID-beige mice bearing Her2/neu-positive tumors treated with Her2Bi-retargeted anti-CD3 activated T cells (ATC). *J Immunotherapy,* Vol. 26(6), S18-S19.

CONFERENCE PRESENTATIONS (✤ Travel support awarded)

Invited and Contributed Talks

- *WPI's 4th Celebration of Science*, Bioengineering Institute, Worcester, Massachusetts. January 10, 2012. Contributed talk: "Modeling the undulatory swimming of sperm: mechanics, biochemistry, and hydrodynamics"

- *64th Annual Meeting of the American Physical Society's Division of Fluid Dynamics (DFD)*. Baltimore, Maryland. November 20 – 22, 2011. Contributed talk: "Hydrodynamic interactions of hyperactivated sperm"
- 2011 Fall Western Sectional Meeting of the AMS, University of Utah, Salt Lake City, Utah. October 22 – 23, 2011. *Invited talk at special session on: Understanding Bio-fluids via Modeling, Simulation, and Analysis*. Talk title: "Hydrodynamic interactions of hyperactivated sperm"
- *48th Annual Technical Conference of Society of Engineering Sciences*, Northwestern University, Evanston, Illinois. October 12 –14, 2011. *Invited talk in minisymposium on: Mesh-Reduction and Mesh-Based Multiscale Computational Models.* Talk title: "An integrative model of sperm motility using an immersed boundary approach"
- *40 Years and Counting: AWM's Celebration of Women in Mathematics*, Brown University, Providence, Rhode Island. September 17-18, 2011. *Invited talk in minisymposium on: Recent advances in numerical methods and scientific computing*. Talk title: "Dynamics of an elastic rod in a viscous fluid: Stokes formulation"
- ✤ *The Fifth q-bio Summer School on Cellular Information Processing,* Los Alamos National Laboratories, Los Alamos, New Mexico. July 24 – August 9, 2011. Contributed talk: "An integrative model of mammalian sperm motility"
- ✤ *Annual Meeting of the European Society of Mathematical and Theoretical Biology joint with the Society of Mathematical Biology*, Krakow, Poland. June 28 – July 2, 2011. *Invited talk in minisymposium on "Fluid-structure interaction problems in biomechanics".* Talk title: "Coupling biochemistry, mechanics, and hydrodynamics to model sperm motility"
- ✤ *Casablanca International Workshop in Mathematical Biology*, Casablanca, Morocco. June 20-24 2011. Contributed talk: "Coupling biochemistry, mechanics, and hydrodynamics to model hyperactivated sperm motility"
- ✤ *National Center for Theoretical Sciences (NCTS) Workshop on Fluid-Structure Interaction Problems,* National Tsing-Hua University, Hsinchu, Taiwan. May 26-29, 2011. Contributed talk: "Dynamics of an elastic rod in a viscous fluid: Stokes formulation"
- *Scientific Computing Around Louisiana,* Tulane University, New Orleans, LA. January 28-29, 2011. Contributed talk: "A mathematical model of sperm motility"
- *2011 Joint Mathematics Meeting*, New Orleans, LA. January 6-11, 2011. AMS Session on Fluid Mechanics, II and Geomechanics. Contributed talk: An integrative model of hyperactivated sperm motility"
- *63rd Annual Meeting of the American Physical Society's Division of Fluid Dynamics (DFD)*, Long Beach, CA. November 21-23, 2010. Contributed talk: "Coupling biochemistry, mechanics, and hydrodynamics to model hyperactivated sperm motility"
- *3rd Annual Women In Mathematics Symposium*. Pomona College, Claremont, CA. November 20, 2010. Contributed talk: "Coupling biochemistry, mechanics, and hydrodynamics to model hyperactivated sperm motility"
- *2010 SIAM Annual Meeting*. Pittsburgh, Pennsylvania. July 12-16, 2010. *Invited talk in minisymposium on "Fluids with Dynamic Microstructure".* Talk title: "An integrative model of spermatozoa motility"
- *SIAM Southeastern-Atlantic Section Conference.* North Carolina State University,

Raleigh, NC. March 20-21, 2009. *Co-organized minisymposium on "Modeling in Biomechanics and Bioengineering" with M.A. Haider.* Talk title: "An integrative model of sperm motility"

- *Scientific Computing Around Louisiana.* Louisiana State University, Baton Rouge, LA. February 5-6. Contributed talk: "CatSper channel mediated Ca^{2+} dynamics in sperm"
- *International Conference on Mathematical Biology and 2009 Annual Meeting of the Society of Mathematical Biology.* University of British Columbia, Vancouver, British Columbia. July 27-30, 2009. Contributed talk: "A model of CatSper channel-mediated Ca^{2+} dynamics in mammalian spermatozoa"
- ✣ *Pacific Northwest Conference on Comprehensive Mathematical Modeling in the Natural and Engineering Sciences Organized in the Spirit of L. A. Segel.* Washington State University, Pullman, WA. June 3-5, 2009. Contributed talk: "A mathematical model of Ca^{2+} Dynamics in Sperm"
- ✣ *Buea International Conference on the Mathematical Sciences and Workshop on Mathematical Biology.* Buea University, Buea, Cameroon. May 12-16, 2009. Contributed talk: "Mathematical Modeling of Cartilage Regeneration"
- *SIAM Conference on Mathematical Aspects of Materials Science*. Philadelphia, PA. May 11-14 2008. *Invited talk in minisymposium on "Swelling Porous Materials".* Talk title: "A level set reaction-diffusion model for cartilage regeneration"

Poster Presentations

- ✣ *South Eastern Atlantic Mathematical Sciences Workshop* (Cha Cha Days). College of Charleston, Charleston, SC. September 24-26, 2010. Poster title: "Coupling biochemistry, mechanics, and hydrodynamics to model hyperactivated sperm motility"
- ✣ *Workshop on Fluid Motion Driven by Immersed Structures*, Fields Institute, Toronoto, ON, Canada. August 9-13, 2010. Poster title: "An integrative model of hyperactivated sperm motility"
- *OCCAM Conference on modeling at different scales in biology*, Oxford University, Oxford, England. June 21-13, 2010. Poster title: "An integrative model of sperm motility"
- ✣ *Workshop on Natural Locomotion in Fluids and on Surfaces: Swimming, Flying, and Sliding*, Institute for Mathematics and Its Applications at the University of Minnesota, Minneapolis, MN. June 1-5, 2010. Poster title: "An integrative model of mammalian sperm motility"
- ✣ *South Eastern Atlantic Mathematical Sciences Workshop* (Cha Cha Days). University of Central Florida, Orlando, FL. November 6-8, 2009. Poster title: "Ca^{2+} dynamics in mammalian spermatozoa"
- ✣ *Current Topic Workshop: Computational challenges in integrative biological modeling.* Mathematical Biosciences Institute at The Ohio State University, Columbus, Ohio. October 5-8, 2009. Poster title: "Mathematical modeling of Ca^{2+} dynamics in sperm"
- *Graduate Student Research Symposium.* North Carolina State University, Raleigh, NC. March 19, 2008. Poster title: "A Level Set Reaction-Diffusion Model For Tissue Regeneration In A Cartilage-Hydrogel Aggregate"
- ✣ *Workshop for Young Researchers in Mathematical Biology*, Mathematical Biosciences Institute at The Ohio State University, Columbus OH. September 11-14,

2007. Poster title: "Modeling articular cartilage regeneration using hydrogel scaffolds via a level set approach"

- *Applications of Analysis to Mathematical Biology (in honor of MC Reed)*, Duke University, Durham, NC. May 21-23, 2007. Poster presentation: "Modeling articular cartilage regeneration using hydrogel scaffolds"
- ✣ *Applications in Biology, Dynamics, and Statistics*, Institute for Mathematics and Its Applications at University of Minnesota, Minneapolis MN. March 5-9, 2007. Poster title: "Supervised learning artificial neural network algorithms for optimizing mechanical properties of elastin-like polypeptide hydrogels for cartilage repair"
- *Annual Meeting for International Society for Biological Therapy of Cancer*, San Francisco, CA. November 4-7, 2004. Poster title: "Enhancing anti-tumor activity against glioblastoma by retargeting T-cells with OKT3 x anti-EGFR"

ADDITIONAL CONFERENCES & WORKSHOPS ATTENDED

- *The Fifth q-bio Summer School on Cellular Information Processing,* Los Alamos National Laboratories, Los Alamos, New Mexico. July 24 – August 9, 2011. **Group Leader** of Cell Signaling Team.
- *NSF-FRG Workshop: The dynamics of elastic biostructures in complex fluids.* Tulane University, New Orleans, LA. November 4-5, 2010.
- *NSF/CBMS Regional Conference in the Mathematical Sciences: The Mathematics of Diffusion.* Tulane University, New Orleans, LA. May 17-21, 2010.
- *Atlantic Coast Symposium on the Mathematical Sciences in Biology and Biomedicine.* Raleigh, NC. April 26-28, 2008.
- *TIMBER Conference for Undergraduates in Mathematical Biology*. Appalachian State, Boone, NC. November 2-3, 2007. *Invited Participant: Graduate Student Panel*
- *Industrial Mathematical & Statistical Modeling Workshop for Graduate Students,* North Carolina State University, Raleigh, NC. July 23-31, 2007. Project title: "Modeling the probability of contaminated drinking water"

SEMINAR TALKS

- Scientific Computing Seminar, Division of Applied Mathematics, Brown University – "Biologically motivated fluid-structure interaction using an immersed boundary framework" (November 11, 2011)
- Applied Mathematics Graduate Student Seminar (alumnae talk), North Carolina State University – "Modeling Biological and Mechanical Aspects of Sperm Motility" (March 22, 2008)
- Applied Mathematics and Computational Seminar, Tulane University. "Mathematical Modeling of Cartilage Regeneration" (September 26, 2008)
- Applied Mathematics Colloquium, Northwestern University. "A Level Set Reaction-Diffusion Model for Cartilage Regeneration" (February 8 2008, recruitment talk)
- Mathematical Biology Seminar, University of Pittsburgh. "A Reaction-Diffusion Model for Cartilage Regeneration using a Level Set Approach" (February 13, 2008, recruitment talk)
- Applied Mathematics Graduate Student Seminar, North Carolina State University.

"Using a Level Set Approach to Model Articular Cartilage Regeneration" (November 26, 2007)

- Biomathematics Seminar, North Carolina State University. "1-d and 2-d Models for Articular Cartilage Regeneration" (November 6, 2007)
- Applied Mathematics Graduate Student Seminar, North Carolina State University. "Predicting Mechanical Properties of Hydrogels Using Artificial Neural Networks" (March 26, 2007)

PROFESSIONAL AFFILIATIONS

Society for Industrial and Applied Mathematics, Society for Mathematical Biology, Association for Women in Mathematics, American Mathematical Society, American Physical Society

COMPUTER SKILLS

Fortran, C, *MATLAB*, *Mathematica*, *Maple*