James Brunner

University of Wisconsin - Madison Department of Mathematics
480 Lincoln Dr.
Madison, WI 53706-1325
www.math.wisc.edu/~jdbrunner

Education

Expected 2018 — *Doctor of Philosophy,* Mathematics
University of Wisconsin - Madison, Madison, WI
Thesis Topic: Persistence and Permanence of Biochemical Reaction Network Models
Areas of Research Interest:

- Dynamical System Modeling in Systems Biology
- Nonlinear Dynamics
- Computational Network Biology
- Continuum Mechanics in Biology
- Stochastic Processes in Biology
- Stochastic Simulation & Monte Carlo Methods
- Functional Analysis
- Stochastic Analysis
- Differential Geometry

Minor: Analysis

Spring 2014 — *Master of Arts,* Mathematics
University of Wisconsin - Madison, Madison, WI

Spring 2012 — *Bachelor of Science,* Mathematical Sciences
University of Michigan, Ann Arbor, MI
Minor: Biology

Research Experience

Ongoing — *A network approach to improving phylogeny classification and analysis in EDGE Bioinformatics.*
Los Alamos National Laboratory
Advisor: Dr. Patrick S.G. Chain
We are attempting to leverage network information to improve the performance of phylogeny classification in the EDGE Bioinformatics platform. `https://github.com/jdbrunner/co_occurrence_net`

Ongoing — *Persistence and Permanence of Biochemical Reaction Networks*
University of Wisconsin - Madison
Advisor: Prof. Gheorghe Craciun
We are investigating the global behavior of dynamical models of biochemical reaction networks in order to characterize networks with the properties of persistence and permanence. This characterization will help to study equilibrium states and periodic behavior in large biochemical networks.

Ongoing — *The Connection Between Network Classifications*
University of Wisconsin - Madison
Advisor: Prof. Gheorghe Craciun
We are investigating the relationships between various structural properties of networks which give rise to dynamical systems used in biology and biochemistry.

Summer 2011 — *Logical Model for Intracellular Iron Metabolism*
Virginia Bioinformatics Institute at Virginia Tech
Advisor: Prof. Rienhard Laubenbacher
We developed a novel polynomial dynamical model for intracellular iron metabolism using data gathered by collaborators at the Wake Forest School of Medicine.

Summer 2010 — *Ordinary Differential Equation Model for Tumor Angiogenesis*
University of Michigan
Advisor: Prof. Trachette Jackson
We adapted an existing model for angiogenesis in tumors to reflect more recent data.

Publications

Accepted	*Robust permanence of polynomial and power law dynamical systems* (with Gheorghe Craciun) to appear in SIAM Journal on Applied Mathematics
Submitted	*Correlation and Co-occurrence Networks in Taxonomic Classification* NSF MSGI Technical Report
In preparation	*A network approach to improving phylogeny classification and analysis in EDGE Bioinformatics.* (with Patrick S.G. Chain and Pavel Senin)
In preparation	*Dominance differential inclusions and a necessary condition for permanence of polynomial dynamical systems.* (with Gheorghe Craciun)
In preparation	*On the connection between endotactic chemical reaction networks and other network classifications.* (with David F. Anderson, Gheorghe Craciun, and Matthew D. Johnston)
In preparation	*Examples and counterexamples in reaction network theory and polynomial dynamical systems.* (with Gheorghe Craciun)

Presentations Given

August 2017	*Robust Permanence of Polynomial and Power Law Dynamical Systems* SIAM Conference on Applied Algebraic Geometry
July 2017	*Robust Permanence of Deterministic Reaction Network Models* Society of Mathematical Biology Annual Meeting
June 2017	*Robust Permanence of Deterministic Reaction Network Models* Banff International Research Station workshop on Mathematical Analysis of Biological Interaction Networks
January 2016	*Persistence and Permanence of Reaction Network Models* MBI Workshop: Dynamics in Networks with Special Properties
November 2015	*Persistence and Permanence of Reaction Network Models* IMA Workshop on Biological Systems and Networks
October 2015	*Permanence in power law systems* AMS Central Fall Sectional Meeting Special Session on Recent Developments in the Theory and Applications of Reaction Network Models
April 2015	*Variations of the Lotka-Volterra System* University of Wisconsin Networks Seminar
March 2014	*Chemical Reaction Network Models* University of Wisconsin Graduate Applied Mathematics Seminar
August 2011	*A Computational Approach to Iron Metabolism in Breast Epithelial Cells* Wake Forest School of Medicine Department of Cancer Biology

Teaching Experience

2017	*Teaching Assistant* University of Wisconsin - Madison, Department of Mathematics Taught Differential Equations
2016	*Teaching Assistant* University of Wisconsin - Madison, Department of Mathematics Taught Linear Algebra (Math Department Teaching Award)
2016	*Directed Reading Program Mentor* University of Wisconsin - Madison, Department of Mathematics Directed undergraduate student in reading project on data networks & clustering
2012 - 2014	*Teaching Assistant* University of Wisconsin - Madison, Department of Mathematics Taught Calculus 2, Calculus 3, and Differential Equations & Linear Algebra

Activities & Outreach

2015 - 2017	*Mega Math Meet Organizer (Middle School Student Competition)* University of Wisconsin - Madison
2017	*University of Wisconsin - Madison SIAM Student Chapter Vice President* University of Wisconsin - Madison

Conferences & Workshops Attended

August 2017	*SIAM Conference on Applied Algebraic Geometry* Presented on *Robust permanence of polynomial and power law dynamical systems* Atlanta, GA
July 2017	*Society for Mathematical Biology Annual Meeting* Presented on *Robust permanence of polynomial and power law dynamical systems* Salt Lake City, UT
June 2017	*Banff International Research Station workshop on Mathematical Analysis of Biological Interaction Networks* Presented on *Robust permanence of polynomial and power law dynamical systems* Banff, AB, CA
May 2017	*EDGE Bioinformatics Workshop* Los Alamos National Laboratory Los Alamos, NM
June 2016	*Seminaire de Mathematiques Superieures 2016: Dynamics of Biological Systems* University of Alberta Edmonton, AB, CA
January 2016	*MBI Workshop: Dynamics in Networks with Special Properties* The Mathematical Biosciences Institute Columbus, OH
November 2015	*IMA Workshop on Biological Systems and Networks* Institute for Mathematics and its Applications Minneapolis, MN
October 2015	*AMS Central Fall Sectional Meeting* Presented on *Permanence in power law systems* Chicago, IL
August 2014	*SIAM Conference on the Life Sciences* Charlotte, NC
January 2012	*AMS Joint Math Meetings* Participated in undergraduate poster competition Boston, MA
November 2011	*Undergraduate Research Conference at the Interface of Biology and Mathematics* Presented *A Computational Approach to Iron Metabolism in Breast Epithelial Cells* NIMBioS at The University of Tennessee, Knoxville, TN

Honors

2017	*Department of Mathematics Teaching Award* University of Wisconsin - Madison Department of Mathematics
2015	*Research Training Group in Analysis and Applications Graduate Fellow* University of Wisconsin - Madison Department of Mathematics
2012	*Outstanding Achievement in Mathematics* University of Michigan Department of Mathematics

Other Skills

Computational Experience	Python, Matlab, R, Excel, Visual Basic for Applications, Linux/Unix