BRENDAN C. FRY

Contact Information

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Academic Interests

I am a mathematics educator, interested in furthering the success and mathematical understanding of undergraduates in STEM fields and courses. My research interests include mathematical biology, applications of discrete math, and mathematics education.

Education and Academic Experience

Metropolitan State University of Denver, Denver, Colorado USA

Assistant Professor, Department of Mathematical and Computer Sciences, August 2016 - present

University of Colorado, Boulder, Colorado USA

Instructor, Department of Applied Mathematics, August 2015 - July 2016

Duke University, Durham, North Carolina USA

Visiting Assistant Professor, Department of Mathematics, August 2013 - July 2015

University of Arizona, Tucson, Arizona USA

Ph.D., Applied Mathematics, May 2013
Minor: Biomedical Engineering
GPA: 4.0 out of 4.0
Advisor: Timothy Secomb
Thesis: Theoretical Models for Blood Flow Regulation in Heterogeneous Microvascular Networks

University of Arizona, Tucson, Arizona USA

M.S., Applied Mathematics, December 2009
GPA: 4.0 out of 4.0
Graduated Summa cum laude

University of Arizona, Tucson, Arizona USA

B.S., Mathematics, May 2008
Minors: Computer Science, Spanish
GPA: 3.8 out of 4.0
Graduated with Honors, Magna cum laude

Teaching Experience

Metropolitan State University of Denver, Denver, Colorado, USA

As an Assistant Professor

Advanced Matrix Methods for the Physical Sciences (MTH 3130)	**Fall 2017**
Calculus I (MTH 1410)	**Fall 2017**
Differential Equations (MTH 3420)	**Spring 2017**
Calculus III (MTH 2420)	**Spring 2017**
Calculus II (MTH 2410)	**Fall 2016, Spring 2018**
Finite Mathematics for the Management and Social Sciences (MTH 1310)	**Fall 2016**

University of Colorado, Boulder, Colorado USA

As an Instructor

Modeling in Mathematical Biology (APPM 4390/5390)	**Spring 2016**
Calculus 1 for Engineers (APPM 1350)	**Spring 2016**
Matrix Methods and Applications (APPM 3310)	**Fall 2015**
Calculus 3 for Engineers (APPM 2350)	**Fall 2015**

Duke University, Durham, North Carolina USA

As a Visiting Assistant Professor

Mathematical Investigations in Genetics and Genomics (MATH 168S)	**Spring 2015**
Ordinary and Partial Differential Equations (MATH 353)	**Fall 2014**
Mathematical Modeling with Writing (MATH 477S)	**Spring 2014**
Multivariable Calculus (MATH 212)	**Fall 2013**

University of Arizona, Tucson, Arizona USA

As a Graduate Teaching Assistant (Full Course Instructor)

Calculus I with Applications (MATH 124)	**Spring 2012**
College Algebra (MATH 112)	**Fall 2009**

As a Graduate Student Mentor

Mathematical Modeling (MATH 485)	**Spring 2011**

As an Undergraduate Teaching Assistant

Introduction to Cryptography (MATH 445)	**Spring 2008**
Second Course in Abstract Algebra (MATH 415B)	**Spring 2007**

Leadership and Outreach

Organizer, Metro Math Day, 2017-present

Organizer, MSU Denver Math Club, 2017-present

Senator, MSU Denver Faculty Senate, 2017-present

Member, MSU Denver College of Letters, Arts, and Sciences Professional Development Committee, 2017-present

Organizer, Panel Discussion on "Tips for Undergraduate Research" at MAA Mathfest, 2017

Organizer, Minisymposium on "Modeling Blood Flow and Oxygen Transport in the Microcirculation" at the Society for Mathematical Biology Annual Meeting, 2017

Participant, MSU Denver New Faculty Institute, 2016-present

Member, CU Boulder Faculty Teaching Excellence Program, 2015-2016

Participant, CU Boulder Discipline Based Education Research, 2015-2016

Faculty Advisor, CU Boulder Undergraduate SIAM Student Chapter, 2015-2016

Volunteer, Colorado Math Circle, 2015-2016

Judge, Association of Computational and Mathematical Modeling (High School Math Competition), 2015

Organizer, Minisymposium on "Mathematical Modeling of Oxygen Transport in Various Tissues"

at the SIAM Conference on the Life Sciences, 2014

Advisor, Mathematical Contest in Modeling, 2014-2015

Volunteer, MathCounts Central North Carolina, 2014-2015

Creator and Organizer, SIAM Journal Club in Mathematical Biology, 2011-2013

Volunteer Coordinator, MC, and Protest Judge, MathCounts Southern Arizona, 2011-2013

Travel Grant Judge, Graduate and Professional Student Council, 2012

Organizer, Arizona Days Applied Math Conference, 2011

Organizer, Applied Math Brown Bag Seminar, 2010-2011

Participant, Professional Development Workshop on Teaching Mathematics, 2009

Vice President, MathCats Undergraduate Math Club, 2006-2008

College of Science Ambassador, 2006-2008

Tutor, Arizona Minority Calculus Workshop, 2007

American Cancer Society Relay for Life Co-Chair, 2006-2007

Honors and Awards

MSU Denver: Provost Mini-Grant (course release), 2018

Burroughs Wellcome Fund: Collaborative Research Travel Grant ($7,500), 2017-2018

Mathematical Association of America: Project NExT Fellowship, 2016-2017

The Microcirculatory Society: Selected to present at the President's Symposium on Discussion of Novel Trends at Experimental Biology 2013, April 2013

American Mathematical Society: Graduate Student Travel Award ($500), November 2012

Society for Mathematical Biology: Landahl Travel Award ($500), June 2012

University of Arizona Graduate Interdisciplinary Programs: Carter Travel Award ($600), May 2012

The Microcirculatory Society: Graduate Student Travel Award ($1000), May 2012

University of Arizona Graduate and Professional Student Council: Graduate Student Travel Award ($500), April 2012

The Microcirculatory Society: Selected to present at the President's Symposium on Young Investigators Novel Trends at Experimental Biology 2012, April 2012

University of Arizona Graduate Interdisciplinary Programs: Winner of Student Poster Competition, November 2011

National Institute of General Medical Sciences (NIGMS) Computational and Mathematical Modeling of Biomedical Systems: Predoctoral Trainee Appointment, January 2010 - December 2011

National Science Foundation VIGRE Fellowship, 2008-2009

Department of Mathematics: Excellence in Undergraduate Research Award, 2008

University of Arizona: National Merit Scholar, 2004-2008

Publications

11. Fry BC, Coburn EB, Whiteman S, Harris A, Siesky B, and Arciero J. Predicting retinal tissue oxygenation using an image-based theoretical model. Submitted to *Mathematical Biosciences*, 2017.
10. Chen Y, Fry BC, and Layton AT. Modeling glucose and lactate metabolism in the kidney. *Mathematical Biosciences* 289: 116-129, 2017.
9. Chen Y, Fry BC, and Layton AT. Modeling glucose metabolism in the kidney. *Bulletin of Mathematical Biology* 78: 1318-1336, 2016.

8. Fry BC, Edwards A, and Layton AT. Impact of nitric-oxide-mediated vasodilation and oxidative stress on renal medullary oxygenation: A modeling study. *American Journal of Physiology – Renal Physiology* 310: F237-247, 2016.
7. Fry BC, Edwards A, and Layton AT. Impacts of nitric oxide and superoxide on renal medullary oxygen transport and urine concentration. *American Journal of Physiology – Renal Physiology* 308: F967-F980, 2015.
6. Sgouralis I, Evans RG, Gardiner BS, Smith JA, Fry BC, and Layton AT. Renal hemodynamics, function, and oxygenation during cardiac surgery performed on cardiopulmonary bypass: A modeling study. *Physiological Reports* 3: e12260, 2015.
5. Fry BC and Layton AT. Oxygen transport in a cross-section of the rat inner medulla: Impact of heterogeneous distribution of nephrons and vessels. *Mathematical Biosciences* 258: 68-76, 2014.
4. Fry BC, Edwards A, Sgouralis I, and Layton AT. Impact of renal medullary three-dimensional architecture on oxygen transport. *American Journal of Physiology – Renal Physiology* 307: F263-F272, 2014.
3. Fry BC, Roy TK, and Secomb TW. Capillary recruitment in a theoretical model for blood flow regulation in heterogeneous microvessel networks. *Physiological Reports* 1(3): e00050, 2013.
2. Fry BC. Theoretical models for blood flow regulation in heterogeneous microvascular networks. Ph.D. Thesis, University of Arizona, 2013.
1. Fry BC, Lee J, Smith NP, and Secomb TW. Estimation of blood flow rates in large microvascular networks. *Microcirculation* 19(6): 530-538, 2012.

Reviewer for

International Journal of Biomathematics, SIAM Undergraduate Research Online, Microcirculation, Frontiers in Physiology, Mathematical Biosciences and Engineering, Journal of Coupled Systems and Multiscale Dynamics, Computers in Medicine and Biology

Graduate and Undergraduate Research Experience

University of Arizona, Tucson, Arizona USA

Graduate Research Assistant **January 2012 - May 2013**

Did research in mathematically modeling metabolic blood flow regulation and oxygen transport in the microcirculation.

- Research topic: "Theoretical models for blood flow regulation in heterogeneous microvascular networks"
- Advisor: Timothy Secomb

NIH Grant Trainee **January 2010 - December 2011**

Did research in mathematically modeling oxygen transport in the microcirculation.

- Research topic: "Modeling the effect of blood flow regulation on oxygen delivery in heterogeneous microvascular networks"
- Advisor: Timothy Secomb

Research Tutorial Group **August - December 2009**

Modeled the response of arteriolar diameters to changes in intraluminal pressure.

- Research topic: "Time-dependent myogenic behavior of arterioles"
- Advisor: Timothy Secomb

Graduate Student Term Paper **January - May 2009**

Developed and tested a model for tumor growth with viral therapy.

- Research topic: "A mathematical model of diffusion-driven tumor growth with viral therapy"
- Advisor: Alain Goriely

Undergraduate Research Assistant **August 2007 - May 2008**
Researched the effects of adding a predator variable to a previous periodical insect population model for Honors thesis.

- Thesis topic: "Semelparous periodical insects"
- Advisor: Jim Cushing

Undergraduate Research Assistant **August 2006 - May 2007**
Researched representations of the symmetric group S_n and how they relate to the irreducible partitions of n.

- Research topic: "Partitions and the symmetric group"
- Advisor: James Cossey

NASA / University of Arizona, Tucson, Arizona USA

Space Grant Intern **August 2005 - May 2006**
Learned how to run molecules through a microwave spectrometer and analyze the results in the lab of the Kukolich group, as well as built a new microwave spectrometer.

- Research topic: "Microwave spectroscopy"
- Advisor: Stephen Kukolich

Professional Experience

Lockheed Martin Corporation, Goodyear, Arizona USA

Applied Mathematics Engineer **June 2008 - August 2008**
Designed algorithms for radar image processing and developed techniques to try to resolve focusing problem for high resolution images. In addition, was in charge of mathematical problems on a team of engineers.

National Security Agency, Fort Meade, Maryland USA

Applied Research Mathematician **June 2007 - August 2007**
Worked in cryptanalysis and in diagnosing an unknown cryptological system, and used probability and statistics to program tests in C and in Python. Also worked with regular expressions to parse through data for desired information.

Funded Conferences Attended

2018 Joint Mathematics Meetings. San Diego, California. January 9-13, 2018.

2017 SIAM Central States Meeting. Fort Collins, Colorado. September 30-October 1, 2017. Presenter.

2017 Mathematical Association of America (MAA) MathFest. Chicago, Illinois. July 26-29, 2017.

Society for Mathematical Biology Annual Meeting. Salt Lake City, Utah. July 17-20, 2017. Presenter.

2017 Joint Mathematics Meetings. Atlanta, Georgia. January 4-7, 2017.

2016 Mathematical Association of America (MAA) MathFest. Columbus, Ohio. August 3-6, 2016.

National Institute for Mathematical and Biological Synthesis (NIMBioS) Investigative Workshop on Algebraic Mathematical Biology. University of Tennessee, Knoxville, Tennessee. July 25-27, 2016.

2016 Joint Mathematics Meetings. Seattle, Washington. January 6-9, 2016. Presenter.

Experimental Biology 2015. Boston, Massachusetts. March 28-April 1, 2015. Presenter.

2015 Joint Mathematics Meetings. San Antonio, Texas. January 9-12, 2015. Presenter.

Society for Industrial and Applied Mathematics (SIAM) Conference on the Life Sciences. Charlotte, North Carolina. August 4-7, 2014. Mini-symposium organizer and presenter.

National Institute for Mathematical and Biological Synthesis (NIMBioS) Tutorial on Algebraic and Discrete Biological Models for Undergraduate Courses. University of Tennessee, Knoxville, Tennessee. June 18-20, 2014.

Mathematical Biosciences Institute (MBI) Workshop on Molecular to Systems Physiology. Ohio State University, Columbus, Ohio. May 5-9, 2014. Presenter.

Experimental Biology 2014. San Diego, California. April 26-30, 2014. Presenter.

Experimental Biology 2013. Boston, Massachusetts. April 20-24, 2013. Presenter.

2013 Joint Mathematics Meetings. San Diego, California. January 9-12, 2013. Presenter.

Society for Mathematical Biology Annual Meeting. Knoxville, Tennessee. July 25-28, 2012. Presenter.

Joint Meeting of the British Microcirculation Society and The Microcirculatory Society. Keble College, Oxford, United Kingdom. July 4-6, 2012. Presenter.

Experimental Biology 2012. San Diego, California. April 21-25, 2012. Presenter.

MBI Workshop for Young Researchers in Mathematical Biology. Ohio State University, Columbus, Ohio. August 29-September 1, 2011. Presenter.

NIMBioS Investigative Workshop on Modeling Renal Hemodynamics. University of Tennessee, Knoxville, Tennessee. August 1-3, 2011. Presenter.

Experimental Biology 2011. Washington, DC. April 9-13, 2011. Presenter.

SIAM Annual Meeting and Conference on the Life Sciences. Pittsburgh, Pennsylvania. July 12-16, 2010.

Mathematical Association of America (MAA) MathFest. Madison, Wisconsin. July 31 - August 2, 2008.

Statistical and Applied Mathematical Sciences Institute (SAMSI) Undergraduate Workshop. SAMSI, Research Triangle Park, North Carolina. February 29 - March 1, 2008 and March 2-3, 2007.

Southwestern Undergraduate Mathematics Research Conference. Arizona State University, Tempe, Arizona. February 22-24, 2008. Presenter.

Arizona Mathematics Undergraduate Research Conference. Western New Mexico University, Silver City, New Mexico. April 27-29, 2007. Presenter.

Presentations

Fry BC. Analyzing the role of blood flow in glaucoma using mathematical modeling. SIAM Central States Meeting, Fort Collins, Colorado. October 1, 2017. Oral presentation. (Invited)

Fry BC. Modeling microvascular blood flow and oxygen transport in tissues with non-uniform structure. Society for Mathematical Biology Annual Meeting, Salt Lake City, Utah. July 17, 2017. Oral

presentation. (Invited)

Fry BC. Impact of kidney structural architecture on oxygen transport: A mathematical model. 2016 Joint Mathematics Meetings, Seattle, Washington. January 7, 2016. Oral presentation.

Fry BC. Impact of kidney structural architecture on oxygen transport: A mathematical model. Applied Mathematics Department Colloquium, University of Colorado, Boulder, Colorado. April 30, 2015. Oral presentation. (Invited)

Fry BC. Impact of kidney structural architecture on oxygen transport: A mathematical model. Applied Mathematics and Statistics Department Colloquium, Colorado School of Mines, Golden, Colorado. April 6, 2015. Oral presentation. (Invited)

Fry BC, Edwards A, and Layton AT. Nitric oxide and superoxide significantly affect medullary oxygenation and urinary output. Experimental Biology 2015, Boston, Massachusetts. March 31, 2015. Poster.

Fry BC. Impact of kidney structural architecture on oxygen transport: A mathematical model. Mathematics Department Colloquium, University of Cincinnati, Cincinnati, Ohio. January 21, 2015. Oral presentation. (Invited)

Fry BC. Effect of structural organization of the kidney medulla on oxygen transport: A mathematical model. 2015 Joint Mathematics Meetings, San Antonio, Texas. January 10, 2015. Oral presentation and poster.

Fry BC. Impact of kidney structural architecture on oxygen transport: A mathematical model. Biomath Seminar, Virginia Commonwealth University, Richmond, Virginia. November 14, 2014. Oral presentation. (Invited)

Fry BC. Assessing the impact of structural organization of the renal medulla on oxygen distribution using a mathematical model. SIAM Conference on the Life Sciences, Charlotte, North Carolina. August 5, 2014. Oral presentation.

Fry BC, Edwards A, Sgouralis I, and Layton AT. Structural organization of the renal medulla has a significant impact on oxygen distribution. MBI Workshop on Molecular to Systems Physiology, Columbus, Ohio. May 6, 2014. Poster.

Fry BC, Edwards A, Sgouralis I, and Layton AT. Structural organization of the renal medulla has a significant impact on oxygen distribution. Experimental Biology 2014, San Diego, California. April 28, 2014. Poster.

Fry BC and Secomb TW. Flow modulation and recruitment in a theoretical model for blood flow regulation in heterogeneous microvascular networks. Experimental Biology 2013, Boston, Massachusetts. April 20, 2013. Oral presentation and poster.

Fry BC. Theoretical models for blood flow regulation in heterogeneous microvascular networks. Quantitative Biology Colloquium, University of Arizona, Tucson, Arizona. February 5, 2013. Oral presentation.

Fry BC and Secomb TW. Theoretical model for metabolic blood flow regulation in a heterogeneous microvascular network. 2013 Joint Mathematics Meetings, San Diego, California. January 9, 2013. Oral presentation and poster.

Fry BC and Secomb TW. Simulation of metabolic blood flow regulation by wall-derived and red-

blood-cell-derived mechanisms: Responses to hemodilution. American Mathematical Society Western Sectional Meeting, Tucson, Arizona. October 28, 2012. Oral presentation. (Invited)

Fry BC and Secomb TW. Simulation of metabolic blood flow regulation by wall-derived and red-blood-cell-derived mechanisms: Responses to hemodilution. Society for Mathematical Biology Annual Meeting, Knoxville, Tennessee. July 28, 2012. Oral presentation.

Fry BC and Secomb TW. Simulation of metabolic blood flow regulation by wall-derived and erythrocyte-derived mechanisms: Responses to hemodilution. Joint Meeting of the British Microcirculation Society and The Microcirculatory Society, Keble College, Oxford, United Kingdom. July 4, 2012. Poster.

Fry BC and Secomb TW. Simulation of metabolic blood flow regulation in heterogeneous microvascular networks: Effects of hematocrit variations. Experimental Biology 2012, San Diego, California. April 21, 2012. Oral presentation and poster.

Fry BC. Simulation of metabolic blood flow regulation in heterogeneous microvascular networks. Modeling and Computation Seminar, University of Arizona, Tucson, Arizona. April 5, 2012. Oral presentation.

Fry BC and Secomb TW. Mathematical model for metabolic blood flow regulation in microvascular networks. Graduate Interdisciplinary Programs (GIDP) Community Event, University of Arizona, Tucson, Arizona. November 17, 2011. Poster.

Fry BC and Secomb TW. Mathematical model for metabolic blood flow regulation in microvascular networks. Graduate and Professional Student Council (GPSC) Student Showcase, University of Arizona, Tucson, Arizona. November 4, 2011. Poster.

Alexander MJ and Fry BC. Models for conducted responses. Quantitative Biology Colloquium, University of Arizona, Tucson, Arizona. October 25, 2011. Oral presentation.

Fry BC and Secomb TW. Mathematical model for metabolic blood flow regulation in microvascular networks. National Alliance Mathematical Field of Dreams Conference, Tempe, Arizona. October 14, 2011. Poster.

Alexander MJ and Fry BC. Introduction to the microcirculation and vascular communication. Quantitative Biology Colloquium, University of Arizona, Tucson, Arizona. October 4, 2011. Oral presentation.

Fry BC. Modeling metabolic blood flow regulation in microvascular networks. Applied Math Brown Bag Seminar, University of Arizona, Tucson, Arizona. September 2, 2011. Oral presentation.

Fry BC and Secomb TW. Mathematical model for metabolic blood flow regulation in microvascular networks. MBI Workshop for Young Researchers in Mathematical Biology, Columbus, Ohio. August 29, 2011. Poster.

Fry BC and Secomb TW. Mathematical model for metabolic blood flow regulation in microvascular networks. NIMBioS Investigative Workshop on Modeling Renal Hemodynamics, Knoxville, Tennessee. August 1, 2011. Poster.

Fry B. Modeling oxygen transport in the microcirculation. Applied Math Brown Bag Seminar, University of Arizona, Tucson, Arizona. April 15, 2011. Oral presentation.

Fry B, Lee J, Smith NP, and Secomb TW. Estimation of blood flow rates in large microvascular

networks based on incomplete boundary conditions. Experimental Biology 2011, Washington, DC. April 11, 2011. Poster.

Fry B. Effects of blood flow distribution on oxygen delivery in a heterogeneous microvascular network. Mathematics Graduate Student Colloquium, University of Arizona, Tucson, Arizona. February 2, 2011. Oral presentation.

Fry B and Shelton D. Stem Cells: Introduction and Ethics. Quantitative Biology Colloquium, University of Arizona, Tucson, Arizona. November 16, 2010. Oral presentation.

Fry B. The effect of blood flow distribution on oxygen delivery in a heterogeneous network. Applied Math Brown Bag Seminar, University of Arizona, Tucson, Arizona. April 30, 2010. Oral presentation.

Fry B. Time-dependent myogenic response of arterioles. Applied Math Second-Year Graduate Research Conference, University of Arizona, Tucson, Arizona. December 18, 2009. Oral presentation.

Fry B. An introduction to modeling tumor growth with viral therapy. Applied Math First-Year Mini-Conference, University of Arizona, Tucson, Arizona. May 15, 2009. Oral presentation.

Fry B, McGuire L, and Shah A. An experimental study of frequency regimes of honey coiling. Applied Math Laboratory Mini-Conference, University of Arizona, Tucson, Arizona. December 3, 2008. Oral presentation.

Fry B. Semelparous Periodical Insects. Southwestern Undergraduate Mathematics Research Conference, Arizona State University, Tempe, Arizona. February 22-24, 2008. Oral presentation.

Fry B. Partitions and the symmetric group. Arizona Mathematics Undergraduate Conference, Western New Mexico University, Silver City, New Mexico. April 27-29, 2007. Oral presentation.

Computer Skills

- Languages: MATLAB, C, Perl, Java, Python
- Applications: LaTeX, Mathematica, and common Windows database, spreadsheet, and presentation software
- Operating Systems: Unix/Linux, Windows

Memberships

American Mathematical Society (AMS), Mathematical Association of America (MAA), The Microcirculatory Society (MCS), Society for Industrial and Applied Mathematics (SIAM), Society for Mathematical Biology (SMB)