



Ioannis Sgouralis

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- EDUCATION**
- Ph.D. in Mathematics* 2014
Duke University, Durham, NC
Mathematical Physiology
Thesis: A Dynamical Nephrovascular Model of Renal Autoregulation
Advisor: Anita T. Layton
- M.A. in Mathematics* 2011
Duke University, Durham, NC
- Diploma in Applied Mathematics* 2009
National Technical University of Athens, Athens, Greece
Applied Analysis and Engineering
Thesis: The Direct Problem of Acoustic Wave Scattering
Advisor: Drossos Gintides
- RESEARCH EXPERIENCE**
- Postdoctoral Research Associate* 2016 – Present
Center for Biological Physics
Arizona State University, Tempe, AZ
- **Data Analysis and Computational Statistics:** I develop a framework for the analysis of single molecule biophysical data based on Bayesian non-parametric and Markov chain Monte Carlo methods.
- Postdoctoral Fellow* 2014 – 2016
National Institute for Mathematical and Biological Synthesis, NIMBioS
University of Tennessee, Knoxville, TN
- **Computational Biology:** (i) *Blood flow control*, I modeled and analyzed the interactions among the autoregulatory mechanisms that lead to stabilization of blood flow against time dependent perturbations; (ii) *Tissue oxygenation*, I developed a comprehensive model of renal oxygen transport that predicts medullary and urinary oxygen tension; (iii) *Muscle contraction*, I developed a model of smooth muscle that combines detailed electrophysiology, calcium signaling, and active tone development; (iv) *Renal failure*, I modeled the pathogenesis of acute kidney injury induced by diabetes and cardiac surgery.
 - **Data Assimilation in Image Processing:** I developed a multi-target tracking algorithm for the automated identification and reconstruction of subcellular motion in *in vivo* microscopy.
- Research Assistant* 2009 – 2014
Department of Mathematics
Duke University, Durham, NC
- **Mathematical Biology:** (i) *Renal hemodynamics*, I developed models of muscle contraction, vascular blood flow, and renal autoregulation; (ii) *Cardiac surgery*, I developed a model of renal oxygenation and used it to assess the mechanisms leading to renal hypoxia during open heart surgery.
 - **Computational Fluid Dynamics:** I developed a numerical method for the solution of the incompressible Navier-Stokes equations that model fluid-structure interactions.

PUBLICATIONS

13. **Ioannis Sgouralis**, Michelle M. Kett, Connie P.C. Ow, Amany Abdelkader, Bruce S. Gardiner, David W. Smith, Yugeesh R. Lankadeva, Clive N. May, and Roger G. Evans, Bladder urine oxygen tension for assessing renal medullary oxygenation in rabbits: experimental and modeling studies, *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 311(3):R532-44, September 2016
12. Mariel Bedell, Yilin Lin, Emmie Román-Meléndez, and **Ioannis Sgouralis***, Global sensitivity analysis in a mathematical model of the renal interstitium, *Involve* (In press, July 2016)¹
11. **Ioannis Sgouralis***, Roger G. Evans, and Anita T. Layton, Renal medullary and urinary oxygen tension during cardiopulmonary bypass in the rat, *Mathematical Medicine and Biology* (In press, June 2016) • recommended on *F1000Prime* 
10. **Ioannis Sgouralis***, Vasileios Maroulas, and Anita T. Layton, Transfer function analysis of dynamic blood flow control in the rat kidney, *Bulletin of Mathematical Biology*, 78(5):923-60, May 2016
9. **Ioannis Sgouralis***, and Anita T. Layton, Conduction of feedback-mediated signal in a computational model of coupled nephrons, *Mathematical Medicine and Biology*, 33(1):87–106, March 2016
8. **Ioannis Sgouralis**, and Anita T. Layton, Mathematical modeling of renal hemodynamics in physiology and pathophysiology, *Mathematical Biosciences*, 264:8-20, June 2015
7. **Ioannis Sgouralis**, Roger G. Evans, Bruce S. Gardiner, Julian A. Smith, Brendan C. Fry, and Anita T. Layton, Renal hemodynamics, function and oxygenation during cardiac surgery performed on cardiopulmonary bypass: a modeling study, *Physiological Reports*, 3(1):e12260, January 2015
6. Yi Li, **Ioannis Sgouralis**, and Anita T. Layton, Computing viscous flow in an elastic tube, *Numerical Mathematics Theory Methods and Applications*, 7(4):555–574, November 2014
5. Brendan C. Fry, Aurelie Edward, **Ioannis Sgouralis**, and Anita T. Layton, Impact of renal medullary three-dimensional architecture on oxygen transport, *American Journal of Physiology - Renal Physiology*, 307(3):F263–272, August 2014
4. **Ioannis Sgouralis***, and Anita T. Layton, Theoretical assessment of renal autoregulatory mechanisms, *American Journal of Physiology - Renal Physiology*, 306(11):F1357–F1371, June 2014
3. **Ioannis Sgouralis***, and Anita T. Layton, Control and modulation of fluid flow in the rat kidney, *Bulletin of Mathematical Biology*, 75(12):2551–2574, December 2013 • recommended on *F1000Prime* 
2. **Ioannis Sgouralis**, and Anita T. Layton, Autoregulation and conduction of vasomotor responses in a mathematical model of the rat afferent arteriole, *American Journal of Physiology - Renal Physiology*, 303(2):F229–F239, July 2012
1. Jing Chen, **Ioannis Sgouralis**, Leon C. Moore, Harold E. Layton, and Anita T. Layton, A mathematical model of the myogenic response to systolic pressure in the afferent arteriole, *American Journal of Physiology - Renal Physiology*, 300(3):F669–F681, March 2011

¹This study involved *undergraduate* research.

*Corresponding author.

**INVITED AND
CONTRIBUTED
TALKS**

6. *Analyzing single molecule measurements with Bayesian non-parametric methods*, APS March Meeting, New Orleans, LA, March 2017
5. *Multicell models in renal physiology*, Investigative Workshop: Many-cell System Modeling, National Institute for Mathematical and Biological Synthesis, Knoxville, TN, July 2015
4. *Modeling of renal oxygenation in diabetes*, Modeling diabetes mellitus: pathogenesis and pharmacotherapy, SMB Annual Meeting, Atlanta, GA, June 2015
3. *A novel algorithm for automatic reconstruction of subcellular motion*, John H. Barrett Lectures 2015, University of Tennessee, Knoxville, TN, May 2015
2. *Mathematical modeling of blood flow control in the kidney*, Mathematics Colloquium, Department of Mathematics, University of Tennessee, April 2015
1. *Development of hypoxia in a model of renal blood flow control and oxygen consumption*, Mathematical Modeling of Oxygen Transport in Various Tissues, SIAM Life Sciences 2014, Charlotte, NC, August 2014

**SEMINAR
TALKS**

10. *Assessment of single molecule dynamics with Bayesian non-parametric methods*, Colloquium, Department of Physics, Indiana University-Purdue University Indianapolis, December 2016
9. *Modeling and analysis of blood transport in the renal circulation*, Seminar, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, May 2016
8. *Mathematical modeling in renal physiology*, Colloquium, Department of Mathematics and Statistics, Wright State University, March 2016
7. *Mathematical modeling of kidney's blood flow*, Seminar, Department of Mathematics and Computer Science, Fisk University, March 2016
6. *Buffering of pressure transients in renal autoregulation*, NIMBioS Casual Seminar, National Institute for Mathematical and Biological Synthesis, April 2015
5. *A computational framework for organelle tracking with applications to plant cells*, Computational Methods of Data Science Seminar, Department of Mathematics, University of Tennessee, February 2015
4. *Mathematical modeling of renal complications induced by cardiac surgery*, NIMBioS Interdisciplinary Seminar, National Institute for Mathematical and Biological Synthesis, December 2014
3. *A dynamical nephrovascular model of renal autoregulation*, Ph.D. Defense Seminar, Department of Mathematics, Duke University, March 2014
2. *Renal autoregulation in a dynamic nephrovascular model*, Graduate/Faculty Seminar, Department of Mathematics, Duke University, November 2013
1. *A numerical method for solving the advection-diffusion equation in moving domains*, Graduate/Faculty Seminar, Department of Mathematics, Duke University, April 2013

**RESEARCH
POSTERS**

10. Ioannis Sgouralis, and Anita T. Layton *Internephron coupling increases the efficiency of dynamic autoregulation*, Experimental Biology 2016, San Diego, CA, April 2016
9. Ioannis Sgouralis, *A large scale model of renal hemodynamics combining the myogenic response and tubuloglomerular feedback mechanisms*, NIMBioS Investigative Workshop Many-cell System Modeling, Knoxville, TN, July 2015

8. Ioannis Sgouralis, Vasileios Maroulas, Andreas Nebenführ, Fernando Schwartz, *A novel filtering algorithm for automatic reconstruction of subcellular motion*, John H. Barrett Lectures 2015, University of Tennessee, Knoxville, TN, May 2015
7. Ioannis Sgouralis, Roger G. Evans, Bruce S. Gardiner, and Anita T. Layton, *Urinary P_{O_2} as a biomarker for medullary hypoxia*, Experimental Biology 2015, Boston, MA, March 2015
6. Ioannis Sgouralis, Roger G. Evans, Bruce S. Gardiner, and Anita T. Layton, *Contribution of hemodilution to renal hypoxia following cardiopulmonary bypass surgery*, Experimental Biology 2014, San Diego, CA, April 2014
5. Ioannis Sgouralis, and Anita T. Layton, *Interactions between myogenic response and tubuloglomerular feedback mechanism*, 2013 FASEB Summer Research Conference: Renal Hemodynamics: Integrating with the Nephron and Beyond, Saxtons River, VT, July 2013
4. Ioannis Sgouralis, and Anita T. Layton, *Nephrovascular interactions in a mathematical model of rat renal autoregulation*, Experimental Biology 2013, Boston, MA, April 2013
3. Ioannis Sgouralis, and Anita T. Layton, *Interactions between tubuloglomerular feedback and the myogenic mechanism of the afferent arteriole*, Experimental Biology 2012, San Diego, CA, April 2012
2. Ioannis Sgouralis, Leon C. Moore, Harold E. Layton, and Anita T. Layton, *Propagation of vasoconstrictive responses in a mathematical model of the rat afferent arteriole*, NIMBioS Investigative Workshop Modeling Renal Hemodynamics, Knoxville, TN, August 2011
1. Ioannis Sgouralis, Leon C. Moore, Harold E. Layton, and Anita T. Layton, *Propagation of vasoconstrictive responses in a mathematical model of the rat afferent arteriole*, Experimental Biology 2011, Washington, DC, April 2011

MENTORING EXPERIENCE	<p><i>Summer Research Experience Mentor</i> 2015 NIMBioS, University of Tennessee, Knoxville, TN</p> <ul style="list-style-type: none"> • Mentees: Mariel Bedell, Yilin Lin, Emmie Román-Meléndez (Summer 2015) Project: Modeling the distribution of fluid pressure in the kidney <p><i>Research for Undergraduates Mentor</i> 2013 – 2014 Department of Mathematics, Duke University, Durham, NC</p> <ul style="list-style-type: none"> • Mentee: Nettie Song (Summer 2014) Project: Modeling efferent arteriole tubuloglomerular feedback • Mentee: Justin Summerville (Summer 2013) Project: Modeling dynamic glomerular filtration
TEACHING EXPERIENCE	<p><i>Instructor</i> 2012 Department of Mathematics, Duke University, Durham, NC</p> <ul style="list-style-type: none"> • Instructor: Calculus II (Math 32L), Spring 2012 <p><i>Teaching Assistant</i> 2009 – 2012 Department of Mathematics, Duke University, Durham, NC</p> <ul style="list-style-type: none"> • Lab Instructor: Laboratory Calculus I (Math 31L), Fall 2009 • Math Help Room: Fall 2009, Spring 2012

REFEREE

- PLOS Computational Biology (2 manuscripts)
- AJP-Renal Physiology (4 manuscripts)
- AJP-Regulatory, Integrative and Comparative Physiology (1 manuscript)
- Journal of Translational Medicine (1 manuscript)
- Journal of Biomedical Engineering and Medical Devices (1 manuscript)
- Autonomic Neuroscience: Basic and Clinical (1 manuscript)
- Hereditary Genetics: Current Research (1 manuscript)
- Austin Journal of Nephrology and Hypertension (1 manuscript)
- International Journal of Respiratory and Pulmonary Medicine (1 manuscript)
- Alexandria Engineering Journal (1 manuscript)

SELECTED ACTIVITIES

- Member of SIAM, SMB and APS
- Participated in *Midwest Quantitative Biology Symposium 2016*, Purdue University, October 2016
- Participated in *John H. Barrett Lectures 2016* on Modeling and Analysis of Non-linear PDEs in Spatial Ecology, University of Tennessee, May 2016
- Participated in *Experimental Biology 2016*, San Diego, CA, April 2016
- Organized a *Grant Writing* seminar session, NIMBioS, March 2016
- Participated in NIMBioS Investigative Workshop *Many-cell System Modeling*, Knoxville, TN, July 2015
- Participated in *John H. Barrett Lectures 2015* on Stochastic Filtering and Applications, University of Tennessee, May 2015
- Participated in *Experimental Biology 2015*, Boston, MA, March 2015
- Participated in NIMBioS Investigative Workshop *Large Scale Modeling of Olfactory Processing*, Knoxville, TN, March 2015
- Participated in *SIAM Life Sciences 2014*, Charlotte, NC, August 2014
- Participated in *Experimental Biology 2014*, San Diego, CA, April 2014
- Participated in Fields Institute Workshop on *Diabetes Systems Biology*, Toronto, Canada, March 2014
- Participated in FASEB Summer Conference on Renal Hemodynamics *Integrating with the Nephron and Beyond*, Saxtons River, VT, July 2013
- Participated in *Experimental Biology 2013*, Boston, MA, April 2013
- Participated in *John H. Barrett Lectures 2012* on Discontinuous Galerkin Finite Elements, University of Tennessee, May 2012
- Participated in *Experimental Biology 2012*, San Diego, CA, April 2012
- Participated in NIMBioS Investigative Workshop *Modeling Renal Hemodynamics*, Knoxville, TN, August 2011
- Participated in SAMSI/Sandia Summer School on *Uncertainty Quantification*, Albuquerque, NM, June 2011
- Participated in *Experimental Biology 2011*, Washington, DC, April 2011
- Participated in *Fluid dynamics, Analysis, and Numerics 2010*, Duke University, June 2010