

NIKOLAOS M. TSOUKIAS

Assistant Professor
Department of Biomedical Engineering
Florida International University
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EDUCATION

- Ph.D.: Engineering, 1999
Dissertation Title: "Characterization of Nitric Oxide exchange in human lungs"
Dissertation Advisor: Steven C. George
University of California, Irvine
- M.S.: Chemical & Biochemical Engineering, 1997
University of California, Irvine
- B.S.: Chemical Engineering, 1994
National Technical University, Athens, Greece

EMPLOYMENT

- (2003-) *Assistant Professor*, Department of Biomedical Engineering, FLORIDA INTERNATIONAL UNIVERSITY, Miami.
- (2000-03) *Postdoctoral Fellow*, Center for Computational Medicine and Biology, Department of Biomedical Engineering, JOHNS HOPKINS UNIVERSITY SCHOOL OF MEDICINE, Baltimore.
- (2001-02) *Lecturer*, Whiting School of Engineering, JOHNS HOPKINS UNIVERSITY, Baltimore.
- (1999-00) *Postdoctoral Fellow*, Department of Chemical and Biochemical Engineering UNIVERSITY OF CALIFORNIA, Irvine.

HONORS & AWARDS

- The 2006 Arthur Guyton Award for Excellence in Integrative Physiology

TEACHING EXPERIENCE

- Mathematical Modeling of Physiological Systems. (BME 6715: FIU Graduate Course)
- Mathematical Modeling of Cellular Systems. (BME 6716: FIU Graduate Course)
- Nonlinear Systems in Life Sciences. (BME 6705: FIU Graduate Course)
- Biomedical Engineering Modeling and Simulation. (BME 2740: FIU Undergraduate Course)
- Senior Design Project. (BME: FIU Undergraduate Course)
- Biological Fluid and Solid Mechanics. (Johns Hopkins Graduate Course)

RESEARCH

- (2003-) Fluorescence microscopy in isolated microvessels.
- (2003-) Design of novel Nitric Oxide therapeutics and administration strategies.
- (2003-) Modeling Calcium dynamics in the microcirculation.
- (2000-) High Performance Computing simulations of oxygen transport in three-dimensional microvascular networks in the presence of hemoglobin-based blood substitutes.
- (2000-) Nitric Oxide transport in the microcirculation in the presence and absence of hemoglobin-based blood substitutes.
- (1999-00) Lung mechanics: Modeling the expiratory flow properties after laser or staple lung volume reduction surgery in emphysema.
- (1998-99) Measurement of the lung diffusing capacity for NO and CO and its dependence on alveolar volume. Model development and experimental determination in healthy human subjects.
- (1997-00) Endogenous NO exchange dynamics in the lung.
- (1997-00) Measurement of endogenous NO in exhaled breath of healthy and diseased human and animal subjects
- (1996-97) Computer simulation of ethanol exchange in the lungs
- (1993-94) Heat and mass transfer in air-drying fruits and vegetables

ADVISEES

Postdoctoral Fellows

- Adam Kapela (2005-)

PhD Students

- Joe Wu (2005-)
- Sabnam Namin (2006-)
- Reshmi Banerjee (2006-)

MS Students (Thesis Option)

- Manu Kanwar (2003-2005)
- Rohit Chawla (2004-2006)
- David Isaza (2003-2005)
- Sara Nofalah (2005-)

Undergraduate Students

- Haroldo Silva (2003-2006)
- Luis Alonso (2006-)
- Adrian Gomez (2006-)
- Jennifer Hall (2005-2006)
- Roxana Ordonez (2006-)

SERVICE AND MEMBERSHIPS

Memberships:

- American Heart Association (AHA)
- American Physiological Society (APS)
- Biomedical Engineering Society (BMES)

Grant Reviewerships:

- American Heart Association

Manuscript Reviewerships:

- Annals of Biomedical Engineering
- European Respiratory Journal
- Respiratory Physiology and Neurobiology
- Medical Engineering & Physics

University Service:

- Search Committees for Faculty Positions, member
- Computational Advisory Committee of the Engineering College, member (2004-)
- Curriculum Committee of the Engineering College, member (2004-06)

PUBLICATIONS

A) PEER-REVIEWED JOURNALS : Average Impact Factor (4.7 citations/paper/year)

- A1 Tsoukias, N. M., Z. Tannous, A. F. Wilson and S. C. George. Single Exhalation Profiles of NO and CO₂ in Humans: Effect of Dynamically Changing Flow Rate. *Journal of Applied Physiology* 85(2):642-652, 1998. [42 citations]
- A2 Tsoukias, N. M. and S. C. George. A Two-Compartment Model of Pulmonary Nitric Oxide Exchange Dynamics. *Journal of Applied Physiology* 85(2):653-666, 1998. [102 citations]
- A3 Tsoukias, N. M., A. F. Wilson and S. C. George. Effect of Alveolar Volume and Sequential Filling on the Diffusing Capacity of the Lung: I Theory. *Respiration Physiology* 120(3):231-250, 2000. [11 citations]
- A4 Tsoukias, N. M., D. Dabdup, A. F. Wilson and S. C. George. Effect of Alveolar Volume and Sequential Filling on the Diffusing Capacity of the Lung: II Experiment. *Respiration Physiology* 120(3):251-271, 2000. [14 citations]

- A5 Tsoukias, N. M. and S. C. George. A Single Breath technique with variable flow rate to characterize Nitric Oxide Exchange Dynamics in the Lungs. *Journal of Applied Physiology* 91(1):477-487, 2001. [22 citations]
- A6 Tsoukias, N.M. and S.C. George. Effect of a Volume Dependent Diffusing Capacity on the Exhalation Profile of NO. *Annals of Biomedical Engineering* 29(9):731-739, 2001. [8 citations]
- A7 Tsoukias, N.M. and A.S. Popel. Erythrocyte consumption of Nitric Oxide in the presence and absence of plasma-based Hemoglobin. *American Journal of Physiology* 282(6):H2265-77, 2002. [17 citations]
- A8 Kavdia M., N.M. Tsoukias and A.S. Popel. A model of Nitric Oxide diffusion in an arteriole: impact of hemoglobin based blood substitutes. *American Journal of Physiology* 282(6):H2245-53, 2002. [18 citations]
- A9 Tsoukias, N.M. and A.S. Popel. A model of nitric oxide capillary exchange. *Microcirculation* 10(6): 479-95, 2003. [11 citation]
- A10 Tsoukias, N.M., M. Kavdia and A.S. Popel. A theoretical model of nitric oxide transport in arterioles: frequency vs amplitude dependent control of cGMP formation. *American Journal of Physiology* 286(3):H1043-56, 2004. [15 citations]
- A11 Kapela, A., Tsoukias N.M. and A. Bezerianos. New aspects of vulnerability in heterogeneous models of ventricular wall and its modulation by loss of cardiac sodium channel function. *Medical & Biological Engineering & Computing* 43(3):387-94, 2005.
- A12 Ji, J.W., N.M. Tsoukias, D. Goldman, and A.S. Popel. A computational model of oxygen transport in skeletal muscle for sprouting and splitting modes of angiogenesis. *Journal of Theoretical Biology* 241(1):94-108, 2006. [1 citations]
- A13 Tsoukias, N. M., D. Goldman, A. Vadapalli, R. N. Pittman and A. S. Popel. A computational model of oxygen delivery by hemoglobin-based oxygen carriers in three dimensional microvascular networks (*submitted*), 2006.
- A14 Silva H.S., A. Kapela and N.M. Tsoukias. A mathematical model of plasma membrane electrophysiology and calcium dynamics in vascular endothelial cells. (*submitted*), 2006.

B) PEER REVIEWED PAPERS IN CONFERENCE PROCEEDINGS:

- B1 Tsoukias, N.M., D. Dabdub, A.F. Wilson, and S.C. George. Alveolar volume and Sequential Filling Impact the Estimation of D_{LCO} and D_{LNO} . *Proceedings of the First Joint BMES/EMBS Conference. 1999 IEEE Engineering in Medicine and Biology 21st Annual Conference and the 1999 Annual Fall Meeting of the Biomedical Engineering Society. Piscataway, NJ, USA: IEEE, 1999. p.346 vol.1.*
- B2 Kapela, A., A. Bezerianos and N.M. Tsoukias. Integrative Mathematical Modeling for Analysis of Microcirculatory Function. *Biological and Medical Data Analysis. Lecture Notes in Bioinformatics:* 161-171, 2006.
- B3 Bezerianos A., A. Kapela and N.M. Tsoukias. Theoretical Investigation of Ca^{2+} Dynamics in Normal and Hypertensive Vascular Walls. *Computers in Cardiology:* 161-171, 2006.

C) ABSTRACTS IN CONFERENCE PROCEEDINGS:

- C1 Tsoukias, N. M., D. S. Mukai, A. F. Wilson and S. C. George. Flow Rate Dependence of Endogenous Nitric Oxide in Humans. *AJRCCM* 155(4):A558, 1997.
- C2 Tsoukias, N. M. and S. C. George. A Two-Compartment Model for the Exchange of Endogenous Nitric Oxide in Human Lungs. *Annals Biomed. Engineer.* 25(1):S10, 1997.
- C3 Tsoukias, N. M. and S. C. George. Elimination Rate: A Technique to Identify Alveolar and Airway Contributions to Exhaled NO. *AJRCCM* 157(3):A369, 1998.
- C4 Tsoukias, N. M., A. F. Wilson and S. C. George. D_{LNO} as A Function of the Alveolar Volume: Effect on Exhaled Nitric Oxide. *Annals Biomed. Engineer.* 25(1):S10, 1998.
- C5 Tsoukias, N. M. and S. C. George. Effect of Production Rates and D_{LNO} on the Shape of the Nitric Oxide Exhalation Profile: A Theoretical Study. *FASEB J.* 12(4):A499, 1998.
- C6 Tsoukias, N. M. and S. C. George. Modeling the Effect of Inspiratory Conditions on the Nitric Oxide Exhalation Profile. *European Respiratory Society*, 1998.
- C7 Tsoukias, N. M. and S. C. George. A New Method to Measure the Dependence of D_{LNO} and D_{LCO} on Alveolar Volume. *AJRCCM* 159(3):A843, 1999.
- C8 Tsoukias N.M., and S.C. George. Does endogenous Nitric Oxide approach an equilibrium concentration in the alveoli at end-exhalation? *AJRCCM* 161(3):A000, 2000.
- C9 Tsoukias, N.M., and S.C. George. A Single Breath Technique with Variable Flow Rate for the measurement of exhaled NO. *European Respiratory Society*, 2000.
- C10 Tsoukias N.M., A. Vadapalli, D. Goldman, and A.S. Popel. A computational study of oxygen transport in microvascular networks in the presence of Hemoglobin Based Oxygen Carriers. *Artificial Cells, Blood Substitutes and Immobilization Biotechnology*,29(2):173, 2001.
- C11 Tsoukias N.M., M. Kavdia, and A.S. Popel. Modeling nitric oxide transport in arterioles in the presence of hemoglobin based oxygen carriers. *Annals Biomed. Engineer.* 29(S1):S58, 2001.
- C12 Tsoukias N.M., A. Vadapalli, D. Goldman, and A.S. Popel. A computational study of tissue oxygenation by hemoglobin based oxygen carriers. *Annals Biomed. Engineer.* 29(S1):S73, 2001.
- C13 Tsoukias, N.M., M. Kavdia, and A.S. Popel. A theoretical model of nitric oxide transport in arterioles: transient versus sustained NO production. *FASEB J.* 16(5):A853, 2002.
- C14 Tsoukias N.M., A. Vadapalli, D. Goldman, and A.S. Popel. A computational study of oxygen delivery by hemoglobin-based oxygen carriers from complex microvascular networks. *FASEB J.* 16(5):A83, 2002.
- C15 Kavdia M., N.M. Tsoukias, A.S. Popel. Effect of hemoglobin-based oxygen carrier on smooth muscle nitric oxide availability. *FASEB J* 16 (5): A853-A853, 2002.

- C16 Kavdia M., N.M. Tsoukias, A.S. Popel. A model of nitric oxide distribution in arterioles in the presence of hemoglobin-based blood substitutes. *IVth International Symposium on Current Issues in Blood Substitutes Research*, Stockholm, Sweden, 2002.
- C17 Tsoukias N.M. and A.S. Popel. Is there frequency encoded information in EDRF? *FASEB J*, 2004.
- C18 Isaza D., M. Kanwar and N.M. Tsoukias. Experimental determination of Nitric Oxide consumption by red blood cells. *Annals Biomed. Engineer. (in press)* 2004.
- C19 Isaza D., and N.M. Tsoukias. Negligible membrane resistance in Nitric Oxide consumption by red blood cells. *FASEB J (in press)*, 2005.
- C20 M. Kanwar, R. Chawla and N.M. Tsoukias. Simultaneous measurement of NO and Ca²⁺ concentrations in isolated perfused rat mesenteric arterioles. *Annals Biomed. Engineer. (in press)* 2005.
- C21 Kapela A., H. Silva, A. Bezerianos and N.M. Tsoukias. A mathematical model of integrated NO/Ca²⁺ dynamics in rat mesenteric microvessels. *Annals Biomed. Engineer. (in press)* 2005.
- C22 Kapela A., H. Silva, A. Bezerianos, N.M. Tsoukias. 'Mathematical model of endothelium-smooth muscle interaction in regulating microcirculatory tone', *FASEB J*. 20(4):A283, 2006
- C23 Silva H., A. Kapela, N.M. Tsoukias. 'A mathematical model of plasma membrane electrophysiology and calcium dynamics in rat mesenteric endothelial cells', *FASEB J*. 20(4):A410, 2006
- C24 Kapela A. and N.M. Tsoukias. 'Conducted vasomotor responses in a multicellular mathematical model of a rat mesenteric arteriole. *Annals Biomed. Engineer.* 2007
- C25 Nofallah S., R. Ordoñez, J. Hall-Ippolito, and N.M. Tsoukias. Estimation of acetylcholine-induced endothelial NO release in vitro using fluorescence microscopy. *Annals Biomed. Engineer.* 2007

D) BOOK CHAPTERS:

- D1 Popel A.S., M. Kavdia, N.M. Tsoukias. Effect of Hemoglobin-based blood substitutes on Nitric Oxide transport: Mathematical models. *Keio University International Symposia for Life Sciences and Medicine Vol. 12. Artificial Oxygen Carrier: Its Frontline.* 2005

E) INVITED PRESENTATIONS:

- E1 4th European Symposium on Biomedical Engineering (University of Patras, June 20-25, 2004)
- E2 Department of Chemical & Biomedical Engineering at FAMU-FSU (Tallahassee, November 12, 2004)
- E3 Systems Analysis, Data Mining and Optimization in Biomedicine" (University of Florida, February 2-4, 2005)
- E4 3rd Summer School on Emerging Technologies in Biomedicine (University of Patras, July 2-7, 2006)
- E5 Mathematical Biosciences Institute (Ohio State University, January 22-26, 2007)
- E6 2007 Experimental Biology (Washington DC, April 28-30, 2007)

F) THESIS :

F1 Study of the shrinkage and porosity in air-drying fruits and vegetables. Diploma Thesis. National Technical University of Athens, Greece, 1994.

F2 Characterization of Nitric oxide exchange in human lungs. Ph.D. Thesis. University of California, Irvine, 1999.

PATENTS :

P1 George S.C. and N.M. Tsoukias. An apparatus and method for the estimation of flow independent parameters which characterize the relevant features of Nitric Oxide production and exchange in the human lungs. (*WO 01/82782; US 6,866,637*)

RESEARCH FUNDING:

RF1 American Heart Association. National Scientist Development Grant (*sole PI*): Signal transduction in the regulation of microcirculatory vascular tone involving Nitric Oxide, 07/01/04-06/30/08. Award amount: \$260,000. [Top 1.28 percentile].

RF2 Arthur Guyton Award for excellence in integrative physiology, 2006. Award amount: \$15,000

RF3 American Heart Association Florida-Puerto Rico Affiliate. Grand-In-Aid (*sole PI*): Signal transduction in the regulation of microcirculatory vascular tone involving Nitric Oxide, 2004. Award amount: \$120,000. (Award was declined as alternative to RF1).

RF4 Access to Biomedical Engineering. Faculty Research Enhancement Award (*sole PI*): NO/Ca²⁺ measurements in isolated vessels of the microcirculation, 2004. Award amount: \$5,000.