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Education

Ph.D. Massachusetts Institute of Technology

M.Sc. University of Belgrade

B.Sc. University of Belgrade

Research & Accomplishments

Current research interests are in developing quantitative approaches to study biological systems at multiple levels of organization (i.e. multiscale modeling). The primary research goal is the development of a theoretical framework that will advance our understanding of how cellular and subcellular phenomena integrate to dynamic behavior of physiological systems, based on the kinetics of underlying molecular processes. These theoretical advances are the foundation for the development of computational platforms to study the interplay between mechanical forces, cell biology, and integrated organ physiology.

This approach could unveil how inferring disease pathophysiology evolves from genetic defects, but it requires a method for translating structural and functional abnormalities at the molecular scale into pathophysiology at the scale of the whole organ. To achieve this we are developing the computational platform **MUSICO** that embodies an interdisciplinary approach, allowing researchers to reveal the molecular origins of physiological functions or dysfunctions of all muscle types. The platform integrates experimental data at multiple scales including cross bridge kinetics and regulation, structure of contractile proteins and interaction between the contractile proteins in 3D sarcomeric structures. The resulting platform can simulate contractile behavior in cells, tissues, and organs. One fascinating features of **MUSICO** simulations in concert with the X-ray diffraction patterns is ability to estimate forces in filaments from living cells during different modes of contraction. Moreover, this program is capable of delineating differences of contractile patterns exhibited by various muscle types, such as fast and slow twitch skeletal muscles and cardiac muscle. The development of these concepts provides a template for studying the mechanisms of inherited or acquired diseases of all muscles types in tissues and in whole organs.

Expertise

- Computational mechanobiology, multiscale modeling of biological systems, biophysics of muscle contraction, X-ray diffraction, muscle biology, cell and tissue mechanics, cardiac and pulmonary physiology.

Projects

- *Multi-Scale Model of Cardiac Muscle Contractile Apparatus for Diagnosis of Disease Dysfunction*, collaboration with University of Washington and Kent University.
- *Multiscale Mechanisms of Lingual Mechanical Function*, collaboration with Brown University.
- *Quantitative Bioengineering Analysis of Muscle Mechanics and Metabolism*, collaboration with Kent University, University of Wisconsin and Monash University.
- *Functional Roles of My-BP-C in Muscle Contraction*, collaboration with University of Vermont.
- *Bioengineering Innovations for Neuromuscular Disease Assessment and Therapy*, collaboration with Beth Israel Hospital and Harvard Medical School.
- *Structural Origins of Smooth Muscle Contraction and Regulation*, collaboration with University of British Columbia.

Awards

- Award for Outstanding Performance, Belgrade University (1973, 1974, 1975)
- Serbian Academy of Science Scholarship (1979)
- Scholarship for M.S. Program, Institute "Mihajlo Pupin" (1980,1981)
- NIH Postdoctoral Fellowship (1997)

Selected Publications

- 2017 Mijailovich SM, Svcevic M, Nedic D, Stojanovic B, Walklate J, Ujfalus Z and Geeves MA. Modeling the Actin.myosin ATPase Cross-bridge Cycle for Skeletal and Cardiac Muscle Myosin Isoforms. *Biophys. J.* 112: .
- 2016 Mijailovich SM, Kayser-Herold O, Stojanovic B, Nedic D, Irving TC, and Geeves MA. Three-dimensional stochastic model of actin-myosin binding in the sarcomere lattice. *J. Gen. Physiol.* 148:459-488, PMID: 27864330.
- 2016 Prodanovic M, Irving TC, Mijailovich SM. X-ray diffraction from nonuniformly stretched helical molecules. *J Appl Cryst.* 49(Pt 3):784-797. PMID: 27275136.
- 2014 Prodanovic M, Irving TC, McOwen R, Mijailovich SM. X-Ray diffraction pattern of non-uniformly stretched actin filament. *Biophys. J.* 106(2):768a.
- 2013 Mijailovich SM, Stojanovic B, Nedic D, Svcevic M, Gilbert RJ, Geeves MA, Irving TC. Modulation of crossbridge cycling kinetics and length dependent calcium sensitivity by titin and nebulin. *Biophys. J.* 104(2):310.
- 2012 Mijailovich SM, Kayser-Herold O, Li X, Griffiths H and Geeves MA. Cooperative regulation of myosin-S1 binding to actin filaments by a continuous flexible Tm–Tn chain *Eur. Biophys. J.* 41(12): 1015-1032. PMID: 23052974.

- 2012 Mijailovich SM, Li X, Griffiths RH and Geeves MA. The Hill model for binding myosin S1 to regulated actin is not equivalent to the McKillop-Geeves model. *J. Mol. Biol.* 417: 112-128. PMID: 22306466.
- 2011 Geeves M, Griffiths H, Mijailovich S, and Smith D. Cooperative $[Ca^{2+}]$ -dependent regulation of the rate of Myosin binding to actin: solution data and the tropomyosin chain model. *Biophys. J.* 100: 2679-2687. PMID:21641313.
- 2010 Mijailovich SM, Li X, del Alamo JC, Griffiths RH, Kecman V and Geeves MA. Resolution and uniqueness of estimated parameters of a model of thin filament regulation in solution. *Comput. Biol. Chem.* 34:19-33. PMID:20060364.
- 2008 Smith DA, Geeves MA, Sleep J. and Mijailovich SM. Towards a unified theory of muscle contraction. I: foundations. *Ann. Biomed. Eng.* 36: 1624-1640. PMID: 18642081.
- 2008 Smith DA, and Mijailovich SM. Toward a unified theory of muscle contraction. II: predictions with the mean-field approximation. *Ann. Biomed. Eng.* 36: 1353-1371. PMID:18506626.
- 2008 Adamovic I, Mijailovich SM and Karplus M. The elastic properties of the structurally characterized myosin II S2 subdomain: a molecular dynamics and normal mode analysis. *Biophys. J.* 94: 3779-3789. PMID: 18234833.
- 2007 MN Oliver, B Fabry, A Marinkovic, SM Mijailovich, JP Butler, JJ Fredberg Airway hyperresponsiveness, remodeling, and smooth muscle mass: right answer, wrong reason? *Am. J. Respir. Cell Mol. Biol.* 37 (3): 264-272. PMID:17463392.
- 2001 Wang N, Naruse K, Stamenović D, Fredberg JJ, Mijailovich SM, Tolić-Nørrelykke IM, Polte T, Mannix R and Ingber DE. Mechanical behavior in living cells consistent with the tensegrity model. *Proc Natl Acad Sci USA.* 98(14):7765-70. PMID: 11438729.
- 2000 Mijailovich SM, Butler JP and Fredberg JJ. Perturbed equilibria of myosin binding in airway smooth muscle: bond-length distributions, mechanics, and ATP metabolism. *Biophys. J.* 79: 2667-2681. PMID: 11053139.
- 1999 Fredberg JJ, Inouye DS, Mijailovich SM, Butler JP. Perturbed equilibrium of myosin binding in airway smooth muscle and its implications in bronchospasm. *Am J Respir Crit Care Med.* 159 (3), 959-967. PMID:10051279.
- 1996 Mijailovich SM, Fredberg JJ, Butler JP. On the theory of muscle contraction: filament extensibility and the development of isometric force and stiffness. *Biophys. J.* 71 (3): 1475-1484. PMID: 8874021.
- 1993 Mijailovich SM, Stamenovic D and Fredberg JJ. Toward a kinetic theory of connective tissue micromechanics. *J. Appl. Physiol.* 74 (2): 665-681. PMID:8458781.

All References: [Mijailovich Google Scholar Link](#)

Professional Societies

- Biophysical Society
- The BMES
- The American Physiological Society
- The American Thoracic Society