

JEAN CARLOS SERRANO

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EDUCATION

Massachusetts Institute of Technology *September 2018 - June 2021*

Ph.D. in Mechanical Engineering

Thesis: On-Chip Engineered Human Lymphatic Microvasculature for Physio-/Pathological Transport Phenomena Studies

Massachusetts Institute of Technology

September 2016 - June 2018

M.S. in Mechanical Engineering

Thesis: Engineering 3D Lymphatic Vasculature On-Chip Through Biochemical and Mechanical Stimuli

University of Puerto Rico at Mayaguez

August 2012 - June 2016

B.S. in Mechanical Engineering (Summa Cum Laude and Highest Class Rank)

Honors Thesis: Adaptive Responses of Murine Osteoblasts Subjected to Coupled Mechanical Stimuli

RESEARCH EXPERIENCE

Massachusetts Institute of Technology

September 2016 - Present

Graduate Student Researcher

Advisor: Roger Kamm

On-Chip Engineered, Physiologically-Functional Lymphatic Vasculature

- Optimized the *in vitro*, angiogenic-induced growth of lymphatic capillaries that mimic their *in vivo* morphology and function, in a versatile microfluidic platform that can be implemented for disease models and drug screening.
- Developed analytical and computational models to study the relevant transport phenomena that drives protein drainage and inflammatory signals by the engineered lymphatic vasculature.
- Additional projects included the development of novel microfluidic systems to recapitulate biomechanical stimuli (microvascular flow and oxygen-tension gradients), as well as computational models to characterize the pathological transport phenomena contributing to our cancer metastasis studies.

Harvard Medical School

June 2015 - August 2015

Undergraduate Student Researcher

Advisor: Guillermo Garcia-Cardena

Engineered Flow-Activated Endothelial Cell Sensor for Atherosclerosis Studies

- Characterized a transcriptionally-activated cellular sensor (KLF2-GFP promoter) capable of exhibiting a quantitative fluorescent response when endothelial cells are exposed to atherosclerosis-prone flow patterns, thus allowing real-time visualization of flow shear stress on cell physiology via fluorescent imaging.
- Validated the versatility of the cell-based sensor as a fluorescent readout in drug screening studies for chemically-inducing an atherosclerosis-protective endothelial phenotype despite the presence of atherosclerosis-prone flow patterns.

Princeton University

June 2014 - August 2014

Undergraduate Student Researcher

Advisor: Howard Stone

Characterizing the Elasticity of Bacterial Biofilms Using a Micro-Membrane Rheometer

- Designed a microfluidic-based rheometer capable of measuring the elasticity of bacterial biofilms by the application of a fixed pressure to a micro-membrane in contact with the biofilm.
- Developed a COMSOL-based finite element analysis model to estimate the elasticity of the bacterial biofilm, based on the experimental measurements of the resultant deformations to the applied pressures.

University of Puerto Rico at Mayaguez

Undergraduate Student Researcher

August 2013 - December 2015

Advisor: Paul Sundaram

Adaptive Responses of Murine Osteoblasts Subjected to Coupled Mechanical Stimuli

· Analyzed the orientational response of the actin cytoskeleton and expression of focal adhesion complexes in murine osteoblasts as a results of simultaneous mechanical cues (matrix stiffness and cyclic tensional strain) to induce preferential cellular alignment for functional bone tissue constructs.

University of Puerto Rico at Mayaguez

Undergraduate Student Researcher

August 2013 - December 2013

Advisor: Paul Sundaram

Cortical Bone Fracture Analysis Using the eXtended Finite Element Method from ABAQUS

· Developed a Python language based algorithm which allowed an XFEM crack propagation analysis in the Finite Element Analysis software ABAQUS for a cortical bone model under mode II crack loading.

PEER-REVIEWED PUBLICATIONS

- **J.C. Serrano**, M. Gillrie, R. Li, R.D. Kamm, On-Chip Engineered Human Lymphatic Microvasculature for Physio-/Pathological Transport Phenomena Studies. (Under Preparation)
- C. Hajal, Y. Shin, L. Li, **J.C. Serrano**, T. Jacks, R.D. Kamm, The CCL2-CCR2 astrocyte-cancer cell axis in tumor extravasation at the brain. *Science Advances*. (Under Revision)
- G. Offeddu*, **J.C. Serrano***, S.W. Chen, S.E. Shelton, Y. Shin, R.D. Kamm, MicroHeart: A Microfluidic Pump for Functional Vascular Culture in Microphysiological Systems. *Journal of Biomechanics*. (2021) *These authors contributed equally to this work.
- **J.C. Serrano***, S. Gupta*, R.D. Kamm, M. Guo, In Pursuit of Designing Multicellular Engineered Living Systems: A Fluid Mechanical Perspective. *Annual Review of Fluid Mechanics*. (2021) *These authors contributed equally to this work.
- C. Hajal, L. Ibrahim, **J.C. Serrano**, G. Offeddu, R.D. Kamm, The effects of luminal and trans-endothelial fluid flows on the extravasation and tissue invasion of tumor cells in a 3D in vitro microvascular platform. *Biomaterials*. (2020)
- R. Koens, Y. Tabata, **J.C. Serrano**, S. Aratake, D. Yoshino, R.D. Kamm, K. Funamoto, Microfluidic platform for three-dimensional cell culture under spatiotemporal heterogeneity of oxygen tension. *APL Bioengineering*. (2020)
- R. Li, **J.C. Serrano**, H. Xing, T.A. Lee, H. Azizgolshani, M. Zaman, R.D. Kamm, Interstitial flow promotes macrophage polarization toward an M2 phenotype. *Molecular Biology of Cell*. (2018)
- T. Osaki, **J.C. Serrano**, R.D. Kamm, Cooperative Effects of Vascular Angiogenesis and Lymphangiogenesis. *Regenerative Engineering and Translational Medicine*. (2018)
- **J.C. Serrano**, J. Cora-Cruz, N. Diffoot, P. Sundaram, Adaptive Responses of Murine Osteoblasts Subjected to Coupled Mechanical Stimuli. *Journal of the Mechanical Behavior of Biomedical Materials*. (2018)

MEETINGS AND CONFERENCE PRESENTATIONS

- **Serrano, J.C.**, Gillrie, M., Kamm, R., “On-Chip Physiological Recapitulation of Lymphatic Microvasculature Structure and Function”. **Biomedical Engineering Society Annual Conference**, October 15, 2020. Virtually Hosted.
- **Serrano, J.C.**, Gillrie, M., Kamm, R., “Engineering 3D, Functional Lymphatic Vasculature On-Chip”. **NSF Center for Emergent Behaviors of Integrated Cellular Systems Annual Conference**, July 8, 2019, Atlanta, Georgia, USA.

- **Serrano, J.C.**, Gillrie, M., Kamm, R., “Engineering 3D, Functional Lymphatic Vasculature On-Chip”. **NSF Center for Emergent Behaviors of Integrated Cellular Systems Trainee Research Symposium**, April 5, 2019, Cambridge, Massachusetts,USA.
- **Serrano, J.C.**, Cora Cruz, J., Diffoot, N., Sundaram, P., “Expression of Focal Adhesions in Response to Cyclic Loading of Substrate in MCF12A cells”. **39th ACS Senior Technical Meeting**, November 7, 2015, poster forum, Ponce,PR.
- **Serrano, J.C.**, Cora Cruz, J., Diffoot, N., Sundaram, P., “Expression of Focal Adhesions in Response to Cyclic Loading of Substrate in MCF12A cells”. **Biomedical Engineering Society Annual Conference**, October 8, 2015, Tampa,Florida,USA.
- **Serrano, J.C.**, Slegtenhorst, B., Garcia-Cardena, G., “Engineering Mechano-Activated Cellular Sensors”. **Leadership Alliance National Symposium**, July 25, 2015, Stamford,Connecticut,USA.
- **Serrano, J.C.**, Cora Cruz, J., Diffoot, N., Sundaram, P., “Expression of Focal Adhesions in Response to Cyclic Loading of Substrate in MCF12A cells”. **5th Undergraduate Research Symposium** , May 2, 2015, oral presentation forum, University of Puerto Rico at Mayaguez,PR.
- **Serrano, J.C.**, Ingremau, F., Stone, H.A., “Characterization of the Mechanical Properties of Bacterial Biofilms using a Micro-membrane Rheometer” . **38th ACS Senior Technical Meeting** , November 7, 2014, poster forum, San Juan,PR.
- **Serrano, J.C.**, Ingremau, F., Stone, H.A., “Characterization of the Mechanical Properties of Bacterial Biofilms using a Micro-membrane Rheometer” . **Leadership Alliance National Symposium**, July 26, 2014, Stamford,Connecticut,USA.

AWARDS AND HONORS

MIT University Center for Exemplary Mentoring (UCEM) Sloan Scholar *2018*
 Awarded in recognition of outstanding academic and mentoring performance, and commitment to pursuing a career in academia. Part of the second cohort at MIT to be awarded this scholarship. Funded by the Alfred P. Sloan Foundation and supported by the Institute of Teaching and Mentoring.

National Science Foundation (NSF) Graduate Research Fellowship *2017*
 A highly competitive national fellowship awarded annually by the National Science Foundation to a selected 2,000 students that will pursue graduate school in a STEM-related field.

MIT Office of the Dean for Graduate Education (ODGE) Diversity Fellowship *2016*
 A full year internal fellowship awarded in recognition of excellence in academia as an effort to increase diversity of the graduate student body at MIT.

NIH RISE 2 BEST Program Award *2013-2016*
 Research fellowship awarded to promising undergraduate students in STEM with outstanding academic achievements, and committed to pursuing a Ph.D degree within the biomedical field.

TECHNICAL STRENGTHS

Programming Languages:	Python, MATLAB, ImageJ1, LaTeX
Finite Element Analysis:	COMSOL Multiphysics, ABAQUS, ANSYS
Microscopy:	Confocal, Epifluorescence, Time-Lapse
Molecular Biology:	Immunofluorescence, Flow Cytometry, ELISA, Western Blot
Microfabrication:	AutoCad, Soft-lithography, Micromachining
Culturing and Handling:	Cells & Tissue, Bacteria
Languages:	Spanish,English(native languages) & French(elementary proficiency)