Jean Carlos Serrano, Ph.D.

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IN BRIEF

5+ years of integrating computational modeling, quantitative imaging, and molecular assays to study pathophysiology and pharmacology in oncology, autoimmune and vascular diseases

Expertise in mechanistic, data-driven, and hybrid models as predictive frameworks across biological scales - from cellular mechanisms to clinical outcomes

Piloted pharma partnerships developing preclinical models through cross-functional collaboration with translational and clinical teams across academic and industry settings

EDUCATION

Massachusetts Institute of Technology *2018 - 2021*
Ph.D. in Mechanical Engineering
Thesis: On-Chip Engineered Human Lymphatic Microvasculature for Physiological Transport Phenomena Studies

Massachusetts Institute of Technology *2016 - 2018*
M.S. in Mechanical Engineering
Thesis: Engineering 3D Lymphatic Vasculature On-Chip Through Biochemical and Mechanical Stimuli

University of Puerto Rico at Mayaguez *2012 - 2016*
B.S. in Mechanical Engineering (Summa Cum Laude)

TECHNICAL STRENGTHS

Modeling and Simulation:	Systems of ODEs and PDEs, Non-Linear Mixed Effects, Finite Element Analysis, Monte Carlo Methods, Machine Learning
Programming Languages:	Python, MATLAB, R, LabVIEW, SQL, LaTeX, HTML
Molecular Biology:	Immunofluorescence Microscopy, Cytometry, PCR, SDS-PAGE
Microfabrication:	Photo/Soft-lithography, Micromachining, 3D Printing
Culturing and Handling:	Mammalian Cells & Tissue, Bacteria

WORK EXPERIENCE

Johnson & Johnson *December 2024 - Present*
Clinical Pharmacology and Pharmacometrics: Principal Scientist

· Led meta-analysis modeling to support Phase 1 to Phase 3 clinical development across 5+ immunology programs, informing trial design optimization, biomarker-to-clinical bridging and go/no-go decisions.
· Developed a clinical data-driven framework characterizing covariate factors contributing to variable placebo responses in atopic dermatitis, improving sample size optimization and drug-effect estimation.
· Applied longitudinal, dose-response, and Bayesian hierarchical models to analyze internal and competitor data, characterizing efficacy-safety profiles, and support regulatory submissions.

Harvard University *August 2024 - February 2025*
Associate Fellow

· Scientific consulting on mRNA-based therapeutics in collaboration with the Wyss Institute.
· Developed a quantitative systems framework linking CAR-T receptor properties to T-cell division outcomes. The derived scaling analyses enable direct molecular parameter optimization for immunotherapeutic efficiency.

Cellino Biotech *May 2023 - July 2024*
Biomedical Engineer

Biophysical Characterization and Modeling of iPSC Biomanufacturing
· Derived analytical and numerical models describing thermodynamic and diffusion-kinetic processes governing cellular response during laser-based bioprocessing of iPSC.
· Optimized biological assays to identify molecular signatures underlying distinctive cell death mechanisms during laser-based cell bioprocessing.
· Developed Python-based image processing pipelines for quantitative analysis of fluorescent data from bioprocess imaging outputs.
· Designed and built instrumentation to measure the physicochemical properties of biocompatible ceramic thin-films, and an optical set-up to visualize flow dynamics in cell-culture chambers.

Harvard University *July 2021 - May 2023*
Postdoctoral Research Fellow

Precision Mixing of Lipid Nanoparticles for Enhanced Drug Delivery
· Extended chaotic mixing principles to develop a novel microfluidic device enabling high-throughput, uniform synthesis of lipid nanoparticles for mRNA vaccine delivery.
· Developed a hybrid data-ODE model to predict optimal lipid nanoparticle synthesis parameters based on therapeutic target requirements.

Wyss Institute for Biologically Inspired Engineering *July 2021 - May 2023*
Postdoctoral Research Fellow

High-throughput, Micro-Patterned Organoid Systems
· Developed microfluidic techniques for single-cell encapsulation in extracellular matrix droplets, thus permitting high-throughput generation and screening of organoid systems for drug target discovery.

Massachusetts Institute of Technology *September 2016 - June 2021*
Graduate Student Researcher

On-Chip Engineered, Physiologically-Functional Lymphatic Vasculature
· Optimized the *in vitro* growth of lymphatic capillaries to mimic their *in vivo* morphology and function, in a versatile microfluidic platform implemented for disease models and drug screening.
· Developed analytical and computational models characterizing lymphatic drainage dysfunction, and inflammatory-chemokine transport during pathological lymphatic-immune interactions.
· Established external collaboration with Amgen Inc. to characterize vascular transport of monoclonal antibodies with novel target engagers. Developed a physiological-based pharmacokinetic (PBPK) framework relating antibody physicochemical properties to differences in predicted bioavailability.
· Additional projects included computational modeling of microfluidic system designs to recapitulate biomechanical stimuli (microvascular flow and oxygen-tension gradients) and predicting cytokine gradients in the brain during cancer metastasis.

Harvard Medical School *June 2015 - August 2015*
Undergraduate Student Researcher

Engineered Flow-Activated Endothelial Cell Sensor for Atherosclerosis Studies

· Characterized a transcriptionally-activated cellular sensor capable of exhibiting a fluorescent response according to patterns of flow shear stress applied on the endothelial cells. This cell-based sensor served as a fluorescent readout for screening drugs that induce protective response in endothelial cells exposed to atherosclerosis-promoting blood flow patterns.

Princeton University *June 2014 - August 2014*
Undergraduate Student Researcher

Characterizing Viscoelasticity of Bacterial Biofilms via Micro-Membrane Rheometry

· Designed a microfluidic-based rheometer capable of measuring the elasticity of bacterial biofilms by the application of fixed air pressure to a micro-membrane in contact with the biofilm channel.

· 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 *August 2013 - December 2015*
Undergraduate Student Researcher

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 result of simultaneous mechanical cues (matrix stiffness and cyclic tensional strain) to induce preferential cellular alignment for functional bone tissue constructs.

PEER-REVIEWED PUBLICATIONS

Google Scholar Profile

1. **J.C. Serrano**, J. Maringwa, R. Straetemans, et al, A Model-Based Meta-Analysis Framework Quantifying Drivers of Placebo Response in Atopic Dermatitis Trials. *Submitted.* (2025)
2. **J.C. Serrano**, M. Pavlovic, M.B. Gilbertsen, K. Janhke, D.A. Weitz, Precision Nanoparticles for Drug Delivery via Microfluidic-enhanced Chaotic Mixing. *Under Review.* (2024)
3. **J.C. Serrano**, M. Gillrie, R. Li, R.D. Kamm, Microfluidic-Based Reconstitution of Functional Lymphatic Microvasculature: Elucidating the Role of Lymphatics in Health and Disease. *Advanced Science.* (2023)
4. G. Offeddu, **J.C. Serrano**, J. Z. Wan, et al, Microphysiological endothelial models to characterize subcutaneous drug absorption. *ALTEX-Alternatives to animal experimentation.* (2022)
5. 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.* (2021)
6. 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.
7. **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.
8. C. Hajal, L. Ibrahim, **J.C. Serrano**, G. Offeddu, R.D. Kamm, The effects of luminal and transendothelial fluid flows on the extravasation and tissue invasion of tumor cells in a 3D in vitro microvascular platform. *Biomaterials.* (2020)

9. R. Koens, Y. Tabata, **J.C. Serrano**, S. Aratake, D. Yoshino, R.D. Kamm, K. Funmoto, Microfluidic platform for three-dimensional cell culture under spatiotemporal heterogeneity of oxygen tension. *APL Bioengineering.* (2020)
10. 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)
11. T. Osaki, **J.C. Serrano**, R.D. Kamm, Cooperative Effects of Vascular Angiogenesis and Lymphangiogenesis. *Regenerative Engineering and Translational Medicine.* (2018)
12. **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)

INTELLECTUAL PROPERTY/PATENTS

- *Single-cell derived organoids in extracellular matrix droplets.* (PCT/US2023/083972)
- *Microphysiological Model of the Brain.* (PCT/US2024/013132)
- *Flexus Mixer: A microfluidic-based mixer for nanoparticle synthesis.* (US patent pending)
- *Optical Engine for Automated Cell Imaging and Bioprocessing.* (US patent pending)
- *Closed-Fluidic Cassette for Long-Term Cell Culture and Manipulation.* (US patent pending)

AWARDS AND HONORS

Invited Keynote Speaker: FluidicMEMS Consortium, Cambridge M.A. *(2024)*

El Mundo Boston's Latino 30 under 30 *(2022)*

MIT University Center for Exemplary Mentoring (UCEM) Sloan Scholar *(2018)*

National Science Foundation (NSF) Graduate Research Fellowship *(2017)*

MIT Office of the Dean for Graduate Education (ODGE) Diversity Fellowship *(2016)*

NIH RISE 2 BEST Program *(2013 - 2016)*

LANGUAGES

English: native, bilingual proficiency
Spanish: native, bilingual proficiency
French: intermediate proficiency