

# 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

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

*August 2024 - February 2025*

- 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**  
**Biomedical Engineer**

*May 2023 - July 2024*

***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**  
**Postdoctoral Research Fellow**

*July 2021 - May 2023*

***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**  
**Postdoctoral Research Fellow**

*July 2021 - May 2023*

***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**  
**Graduate Student Researcher**

*September 2016 - June 2021*

***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**  
**Undergraduate Student Researcher**

*June 2015 - August 2015*

### ***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**  
**Undergraduate Student Researcher**

*June 2014 - August 2014*

### ***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**  
**Undergraduate Student Researcher**

*August 2013 - December 2015*

### ***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 trans-endothelial fluid flows on the extravasation and tissue invasion of tumor cells in a 3D in vitro microvascular platform. *Biomaterials*. (2020)

9. R. Koenig, 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)
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*. (19/285,320-PCT/US25/39796)
- *Closed-Fluidic Cassette for Long-Term Cell Culture and Manipulation*. (19/285,250-PCT/US25/39796)

## 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