

# Spencer Hobson-Gutierrez

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Researcher in mathematical and theoretical biology with training in physics and mathematics, working at the intersection of evolutionary dynamics, population biology, and quantitative cell biology. I develop theoretical frameworks, drawing on stochastic processes and spectral methods, to understand how heritable variation and regulatory mechanisms at the cellular level shape population fitness and evolutionary dynamics.

## Education:

Ph.D. in Biology: New York University, 2019-2026  
M.S. in Mathematics: Kansas State University, 2013-2015  
B.Sc. in Mathematics and B.Sc. in Physics: Kansas State University, 2009-2013

## Publications:

**Hobson-Gutierrez, S.**, and Kussell, E.  
Evolutionary advantage of cell size control in bacteria.  
*Physical Review Letters* (2025). doi: 10.1103/PhysRevLett.134.118401

Guzelsoy, G., Elorza, S. D., Ros, M., Schachtner, L. T., Hayashi, M., **Hobson-Gutierrez, S.**, et al.  
Cooperative nutrient scavenging is an evolutionary advantage in cancer  
*Nature* (2025). doi: 10.1038/s41586-025-08588-w

**Hobson-Gutierrez, S.** and Carmona-Fontaine, C.  
The metabolic axis of macrophage and immune cell polarization  
*Disease Models & Mechanisms* (2018). doi: 10.1242/dmm.034462

## Research Experience:

### Ph.D. Student, New York University, 2019-2026

**Advisor:** Edo Kussell

- Devised a novel argument for how cell-size control mechanisms induce lineage-level correlations that act as an effective epigenetic memory for birth size, and showed how these correlations alter population growth rates, demonstrating how cell-size regulation strategies like adder may increase fitness.
- Formulated size-structured population dynamics as a positive transfer (integral) operator on birth-size distributions; characterized long-term growth via the principal eigenvalue (Krein-Rutman/Perron-Frobenius framework).
- Developed analytic approximations for correlated inheritance using persistence-length (polymer-style) coarse-graining, yielding closed-form scaling laws for growth rate and optimal size regulation.
- Developed from-scratch, high-performance stochastic population simulations in C to validate spectral predictions, alongside numerical eigenvalue solutions of discretized evolution operators in MATLAB

### Junior Research Scientist, New York University

2017-2018

**PI:** Dr. Carlos Carmona-Fontaine's Lab

- Mechanistic and spatial modeling of cancer cell cooperation and metabolic interactions.
- Mathematical and numerical modelling of metabolite exchange and its role in tumor-immune cell phenotypic modulation.
- Co-authored review on tumor metabolic microenvironments and immune cell polarization.

- Development and optimization of computational pipelines for high-throughput fluorescent imaging analysis [MATLAB, Bash, DOS].
- Vectorized and GPU-accelerated image analysis pipelines achieving order-of-magnitude performance improvements [MATLAB, CUDA].

## **Talks and Presentations:**

### **Invited Talks**

Joint Mathematics Meeting, DC

*AMS Special Session on Stochastic Processes in Biology I* (2026)

Erwin Schrödinger Institute, Vienna

*Extremal Statistics in Biology Workshop* (2025)

New York Bacillus Interest Group (NYBIG), NYC

*Annual Symposium on Molecular Microbiology and Prokaryotic Cell Biology* (2023)

### **Contributed Talks**

*American Physical Society March Meeting* (scheduled, 2026), Denver

*American Physical Society March Meeting* (2023), Las Vegas

## **Awards & Fellowships from NYU:**

### **Gladys Matejko Research Award, Awarded 2025**

Awarded to a senior doctoral student for excellence in research, academic achievement, and departmental engagement; based on peer-reviewed publications and professional presentations.

### **Quantitative Biological Systems Training (QBIST) Program (NIH T32), Awarded 2019**

Selected participant in an interdisciplinary quantitative biology training program emphasizing statistical, computational, and systems-level approaches to biological research.

### **Henry MacCracken Graduate Fellowship, Awarded 2018**

Merit-based institutional fellowship providing tuition, stipend, and benefits in support of doctoral study.

## **Teaching Experience:**

### **New York University**

- Biostatistics (Fall 2019)
- Applied Genomics (Spring 2020, Spring 2021)

### **Kansas State University**

- Course Coordinator: Single Variable Calculus
- Instructor: General Calculus
- Recitations: College Algebra, Trigonometry, Matrix Theory / MATLAB
- Undergraduate research mentoring (I-Center)