

# Integrative and Quantitative Biosciences Accelerated Training Environment @ GT

## Participating Program Faculty

Figure 2: Training Faculty in InQuBATE				PhD Programs							Discipline and Approach					
Last, First	Title	School	College	QBioS	BioE	BME	CSE	ML	Biology	Physics	Molecular & Cellular	Organismal	Population	Theory	Data Analytics	Experimental
Weitz, Joshua	Prof	Biology	Sciences	x	x		x		x			x	x	x	x	
Qiu, Peng	Assoc Prof	BME	Engineering		x	x	x	x			x	x		x	x	
Brown, Sam	Prof	Biology	Sciences	x					x		x		x	x	x	x
Cherry, Elizabeth	Assoc Prof	CSE	Computing				x					x		x		
Dyer, Eva	Asst Prof	BME	Engineering		x	x		x			x	x	x	x	x	
Fenton, Flavio	Prof	Physics	Sciences	x						x		x	x	x		x
Gumbart, James	Assoc Prof	Physics	Sciences	x	x					x	x			x		
Kubaneck, Julia	Prof	Biology	Sciences	x					x		x					x
Kowng, Gabe	Assoc Prof	BME	Engineering		x	x					x					x
Lu, Hang	Prof	ChBE	Engineering		x	x			x			x				x
Park, Haesun	Prof	CSE	Computing				x	x						x	x	
Ratcliff, Will	Assoc Prof	Biology	Sciences	x					x			x	x			x
Torres, Matthew	Assoc Prof	Biology	Sciences	x					x		x				x	x
Whiteley, Marvin	Prof	Biology	Sciences	x					x		x	x	x		x	x
Zhang, Xiuwei	Asst Prof	CSE	Computing				x	x						x	x	

**Joshua Weitz** is the Patton Distinguished Professor of Biological Sciences and Founding Director of the Quantitative Biosciences Graduate Program at Georgia Tech. Dr. Weitz arrived at Georgia Tech in 2007, where he has risen in the ranks from Assistant to Associate to Full Professor, with adjunct appointments in Physics and Electrical and Computer Engineering, as well as program faculty status in the PhD programs of Bioengineering, Machine Learning, and Bioinformatics. Dr. Weitz is internationally recognized for his contributions in quantitative viral ecology and authored *Quantitative Viral Ecology: Dynamics of Viruses and Their Microbial Hosts*; Princeton University Press (2015) awarded the 2016 best postgraduate textbook prize by the Royal Society of Biology. His research makes substantial new contributions into how virus-microbe interaction structure population dynamics and ecosystem function. Dr. Weitz was recognized in 2017 as an AAAS Fellow for his contributions to quantitative viral ecology, recognized in 2019 as a Fellow the American Academy of Microbiology, and was awarded the Charles Blaise Pascal International Chair of Excellence at the Ecole Normale Supérieure, Institute of Biology effective August 2019. At Georgia Tech, Dr. Weitz was recognized in 2020 with the Class of 1934 Award for Interdisciplinary Activities in light of his contributions to the development of the quantitative biosciences graduate program and was also awarded the Graduate Student Faculty of the Year Award in support of his advocacy for graduate student activities and sustainable support on campus. Dr. Weitz has extensive experience in training programs, was a Co-PI of a multi-year ‘Physics of Living Systems’ student training grant and is now Senior Personnel on the renewed training grant. Dr. Weitz has developed multiple graduate level classes, including courses on Systems Biology, Theoretical Ecology, and ‘Foundations of Quantitative Biosciences’. Dr. Weitz is currently completing work on a multi-component textbook and computational lab guide on Quantitative Biosciences under contract with Princeton University Press. Dr. Weitz is also the lead organizer of an annual workshop series on ‘Hands-On Modeling in Quantitative Biosciences’, including workshops held in May 2017, 2018, 2019, and 2020 Dr Weitz is also a committed mentor; all 11 of his former PhD students have been placed into academic or industry positions within 6 months of graduation with PhDs in Physics (5), Bioinformatics (4), Biology (1), and Electrical and Computer Engineering (1). All former PhD students remain in either academic (as postdocs or faculty) or in data-science jobs in industry (e.g., Adobe, DNANexus) or as part of non-profit foundations (e.g., Chan Zuckerberg Initiative). Weitz currently mentors 7 PhD students including 5 from Quantitative Biosciences, 1 from Physics, and 1 from Electrical and Computer Engineering. In addition, all 13

former MS students were placed into jobs or PhD programs within 6 months of graduation. Weitz has placed 8 former postdocs into tenure track positions (two of whom have already received tenure), four others into industry positions in the biological data sciences, and currently supervises 4 postdoctoral scientists. Weitz has also mentored 19 undergraduate students.

**Peng Qiu** is an Associate Professor of Biomedical Engineering at Georgia Tech and Emory. Dr. Qiu's main research interests lie in the area of machine learning and systems biology, with a focus on single-cell genomics, integrative analysis, systems modeling, and signal processing. He is internationally recognized for his contributions in computational methods for single-cell analysis. He developed the SPADE algorithm for revealing cellular differentiation hierarchy in flow cytometry and CyTOF data, which is the first algorithm for discovering biological progression in high-dimensional data, and started the area of trajectory finding in the single-cell research community. Dr. Qiu is a recipient of the NSF CAREER award and an ISAC Marylou Ingram Scholar. His work achieved top performance in multiple computational competitions, including the DREAM6/FlowCAP2 AML prediction challenge in 2011, the FlowCAP3 rare cell identification challenge in 2012, the CYTO image analysis challenge in 2017, and the DREAM single cell transcriptomics challenge in 2018. At Georgia Tech, Dr. Qiu was recognized in 2018 as a Carol Ann and David D. Flanagan Faculty Fellow for his research activities, and in 2019 as a Hesburgh Award Teaching Fellow for his teaching achievements. Dr. Qiu has developed a new graduate-level course titled "Machine Learning in Biosciences", which combines machine learning techniques with single-cell genomics and systems biology applications. In collaboration with Dr. Kwong, Dr. Qiu co-developed a new graduate level course on the emerging field of Immunoengineering that has been offered since 2016. Dr. Qiu is a committed mentor. He is currently advising 4 PhD students (2 from Biomedical Engineering, 1 from Machine Learning, 1 from Bioinformatics), and 4 MS students (all from Bioinformatics). He has graduated 5 PhD students and mentored 4 postdoctoral fellows. Among these trainees, 6 joined industry and 3 joined academia (two of whom are currently TT assistant professors, and the third one is currently a tenured associate professor).

**Sam Brown** is a Professor of Biological Sciences, and Director of the Center for Microbial Dynamics and Infection (CMDI). His research is focused on the multi-scale dynamics of microbial infections, from molecular interactions among co-infecting bacteria through to epidemiological and evolutionary dynamics across populations of hosts and the environment. His PhD graduates and postdoctoral trainees have gone on to careers in academia and data sciences. In his role as CMDI Director, he has promoted careers mentorship through the establishment of a quarterly careers networking event for CMDI PhD and postdoctoral trainees, an early career seminar program that features student and postdoctoral talks, and the support of individualized support for grant submissions by early career researchers at both the predoctoral and postdoctoral phase.

**Elizabeth Cherry** is an Associate Professor of Computational Science and Engineering. Her research involves modeling and simulation, high-performance computing, and numerical methods with a focus on computational modeling of cardiac arrhythmias, including model development, validation, and parameter estimation; integration with experiments through data assimilation; and applications to understand the mechanisms responsible for complex physiological behavior. Prior to joining Georgia Tech in 2019, she was an Associate Professor in the School of Mathematical Sciences at Rochester Institute of Technology, where she served as the first program director of the new interdisciplinary Mathematical Modeling graduate program. She has developed several interdisciplinary courses, including high-performance computing for mathematical modeling and biomedical modeling, and she has directed several interdisciplinary workshops for undergraduate students that included students from math, computing, physics, biomedical engineering, biology, and chemistry. She has received the 2019 Trustees Scholarship Award, the highest research honor bestowed at RIT; a College-level Outstanding Student Mentoring Award in 2016; Outstanding Faculty of the Year awards at both the College (2013) and School (2014) levels; and a School-level Advocate for Minority Students & Faculty Award.

**Eva Dyer** is an Assistant Professor in the Coulter Department of Biomedical Engineering at the Georgia Institute of Technology and Emory University. Dr. Dyer works at the intersection of neuroscience and machine learning, developing computational approaches to interpret complex neuroscience datasets, and designing new machine intelligence architectures inspired by the organization of biological brains. She is the recipient of an NSF CISE Research Initiation Initiative Award, a Sloan Fellowship in Neuroscience, and is a current Allen Institute for Brain Science Next Generation Leader. In addition to her research accomplishments, Dr. Dyer's passion for teaching has propelled her to make meaningful contributions towards advancing education at Georgia Tech and beyond.

In her first year at GT, she participated in a College-level committee to develop a new interdisciplinary course in data science and machine learning for undergraduates throughout the College of Engineering (COE). With this format, students from across many disciplines within engineering could work with one another to learn data science and machine learning in a problem-based format. Dr. Dyer now serves as the Diversity & Inclusion Chair for the leading computational and systems neuroscience conference, Cosyne, and the Executive Board for the NSF-Simons Southeast Center for Mathematics and Biology.

**Flavio Fenton** is Flavio H. Fenton is a Professor of Physics and APS fellow. He uses a combined approach in his lab of theory, experiments, and computer simulations in the study of excitable media, complex systems, and pattern formation, with a particular emphasis on the study of cardiac arrhythmias. He has successfully identified key mechanisms that initiate or sustain arrhythmias and has developed control and new low energy defibrillation strategies, all supported by NSF, NIH and AHA grants. With a strong passion for teaching he has received various awards including Junior Faculty Teaching Excellence, Junior Faculty Outstanding Undergraduate Research Mentor, G.B. Eichholz Faculty Teaching Awards, and is currently a 2020-2021 Governor's Teaching Fellow for the State of Georgia. Several of his Ph.D. students are now university professors.

**JC Gumbart** is an Associate Professor of Physics at Georgia Tech. His research is focused on simulating biological systems and processes at the atomistic scale, particularly those involved in infection. Examples include transport of both nutrients and drugs across the cell envelope of Gram-negative bacteria as well as the assembly of virus capsids, all in close collaboration with experimental labs and all NIH funded. To date, four of his students have received their PhD and all immediately went on to postdoctoral positions or consulting. Since 2015, he has also taught a 1-hour seminar course taken by all physics undergraduates focused on both graduate school and career preparation. Dr. Gumbart now serves as Associate Director of Quantitative Biosciences PhD program focusing on career development initiatives for participating students.

**Julia Kubanek** is a Professor of Biological Sciences and Chemistry & Biochemistry, and Associate Dean of Research in the College of Sciences at Georgia Tech. Her areas of research expertise include chemical communication, chemical biology, natural product drug discovery, and metabolomics, largely exploring the use of small molecules and biomolecules as chemical signals between cells and organisms. She has designed and taught interdisciplinary undergraduate and graduate courses in chemical signaling and served as co-PI and PI on graduate and undergraduate training programs. Her PhD graduates have gone on to NIH-funded postdoctoral fellowships and careers in academia and industrial biomedicine and chemistry. In her role as associate dean, she supports faculty and student research development through facilitation of interdisciplinary programs.

**Gabe Kwong** is an Associate Professor of Biomedical Engineering at Georgia Tech and Emory. His research program merges advances in bioengineering with discoveries in immunology to solve clinical challenges in cancer, transplantation medicine, and cell-based therapies. Dr. Kwong is recipient of the NIH Ruth L. Kirschstein Award, Burroughs Wellcome Fund Career Award, GT/British Petroleum Junior Faculty Teaching Award, NIH Director's New Innovator Award, Shurl and Kay Curci Foundation Award, and the TEDMED Hive Innovator. He closely mentors the success of his trainees which include 5 NSF Graduate Fellows and 2 Goldwater Scholars. Trainees that have graduated from his lab have gone on to research scientist positions in cell therapy and biomedical diagnostic companies. He teaches undergraduate and graduate level courses and along with Dr. Peng Qiu, co-developed a new graduate level course on the emerging field of Immunoengineering that has been offered since 2016. He is on the steering committee of two NIH-funded T32 training programs at Georgia Tech in Biomaterials and Immunoengineering respectively.

**Hang Lu** is the Love Family Professor of Chemical & Biomolecular Engineering and Director of the Interdisciplinary Bioengineering Graduate Program at Georgia Tech, and program faculty in BME and Biological Sciences. Her lab is interested in engineering micro systems and automation tools and addressing questions in systems neuroscience, developmental biology, and cell biology that are difficult to answer with conventional techniques. She is the recipient of the Pioneer of Miniaturization award (CBMS), the ACS Analytical Chemistry Young Innovator award, a NSF CAREER award, a Sloan Foundation Research Fellowship, a DuPont Young Professor Award, a DARPA Young Faculty Award, Council of Systems Biology in Boston (CSB2) Prize in Systems Biology, and Georgia Tech Outstanding PhD Thesis Advisor Award among others. She is an elected fellow of American Association for the Advancement of Science (AAAS) and an elected fellow of the American Institute for Medical and Biological Engineering (AIMBE). In her 15 years at Georgia Tech, she has graduated

23 PhD students, with 13 in training. Among her trainees are an associate professor at MIT, 2 Burroughs-Wellcome Career at the Interface awardees, multiple NIH K and F awardees, and NSF graduate research fellows.

**Haesun Park** is Regents' Professor in the School of Computational Science and Engineering (CSE), at Georgia Tech. She was elected as a SIAM Fellow in 2013 and IEEE Fellow in 2016 for her outstanding contributions in numerical computing, data analysis, and visual analytics. She developed the CSE PhD and MS programs as associate chair of the School of CSE 2007-2013 and was appointed Chair of CSE in August 2020. Dr. Park was an executive director of the Center for Data Analytics 2013-2015, and director of the NSF/DHS FODAVA-Lead (Foundations of Data and Visual Analytics) Center 2008-2014 and led 17 FODAVA partner teams from US universities creating and advancing the foundations of visual analytics and curriculum. She has published extensively in the areas of numerical algorithms, scalable data analysis, visual analytics, text and network mining, bioinformatics, and parallel computing. She served on numerous conference committees and advisory boards, and as the conference co-chair for the SIAM International Conference on Data Mining in 2008 and 2009. She was an editorial board member of leading journals such as IEEE Transactions on Pattern Analysis and Machine Intelligence, SIAM Journal on Matrix Analysis and Applications, and SIAM Journal on Scientific Computing. Dr. Park has supervised 22 PhD students, 11 postdoctoral fellows/research scientists, and 18 MS students.

**Will Ratcliff** is an Associate Professor of Biological Sciences at Georgia Tech. His research focuses on the evolution of complex life- specifically, understanding how multicellular organisms can evolve from unicellular ancestors. His research has been influential, inverting the long-held belief that the transition to multicellularity is necessarily slow and difficult. He is the recipient of major awards including a NSF CAREER award in 2019, a Packard Fellowship in Science and Engineering in 2016, being named one of Popular Science's 'Brilliant 10', and a Sigma Xi Young Faculty Award. In 2018 he was awarded a visiting professorship in mathematical biology at École Normale Supérieure in Paris. Dr. Ratcliff is currently editing a book on the origin of multicellular life, providing a comprehensive overview of this field for new graduate students. Ratcliff created a course at Georgia Tech entitled "The Origin of Complex Life: from Cells to Societies", and in 2017 received a "Class of 1940 Course Survey Teaching Effectiveness Award". Ratcliff currently mentors 5 PhD students, 3 postdocs and 5 undergraduates. He had graduated two PhD students, one is a postdoc and one is in industry. At GT Ratcliff has mentored 22 undergraduates, three have won institute awards and five have gone on to PhD programs.

**Matt Torres** is an Associate Professor of Biological Sciences at Georgia Tech. His research is focused on mass spectrometry-based proteomics, cell signaling and bioinformatics, with an emphasis on protein post-translational regulation. Particular areas of research include machine learning models for meta-analysis of proteomics data, mechanisms of G protein regulation by protein modification, and intrinsically disordered proteins. He also serves as co-director of the Systems Mass Spectrometry Center at Georgia Tech. He teaches undergraduate Genetics as well as a graduate course in Proteomics. To date, one of his students has received their PhD and immediately went on to a postdoctoral position at Genentech (South San Francisco Campus).

**Marvin Whiteley** is a Professor of Biological Sciences, the Bennie H. & Nelson D. Abell Chair in Molecular and Cellular Biology, a Georgia Research Alliance Eminent Scholar, and Co-Director of the Emory-Children's Cystic Fibrosis Center. In broad terms, the Whiteley lab is interested in three research areas: (a) understanding how bacterial interactions shape community structure in both pathogenic and commensal bacterial populations, (b) quantifying the accuracy of model systems used to study microbial interactions, and (c) examining how microbial population spatial structure impacts how these communities interact with the host. The lab is highly interdisciplinary, using systems level approaches, analytical chemistry, animal models of infection, human-derived samples, bioengineering, and biochemistry to tackle these challenging questions. Dr. Whiteley is highly qualified to serve on this leadership team because: (1) he has served on the graduate admissions committees for both the Microbiology and Cell and Molecular Biology graduate programs while at UT-Austin, (2) he has over 15 years of graduate student training experience and every trainee has been highly productive (2 first author publications or more) and has moved on to a productive career in science, (3) he founded the Center for Infectious Disease at UT-Austin and the Center for Microbial Dynamics and Infection at GT, the latter of which has initiated training opportunities for both graduate students and post-doctoral fellows, (4) he has served in numerous administrative positions including ASM Division D chair (*Microbe-Host Interactions*), *President of the Texas Branch ASM*, and *Faculty Council at UT-Austin*, (5) he travels extensively (frequently as a graduate student invited speaker) which allows him to interact with graduate students from around the country, (6) his research is highly interdisciplinary, utilizing genomics and nanotechnology to probe host-bacterial interactions,

(7) he is an award-winning teacher and has taught both graduate and undergraduate courses in Microbiology. Dr. Whiteley currently has grants from the NIAID, NIGMS, NIDCR, Burroughs Wellcome, Cystic Fibrosis Foundation, UK CF Trust, and Curci Foundation. He serves as an editor of mBio and Infection and Immunity and is an elected member of the American Academy of Microbiology.

**Xiuwei Zhang** is an Assistant Professor of Computational Science and Engineering at Georgia Tech. Her research interests include developing generative models to simulate various types of data of cells, including single cell gene-expression data, single cell ATAC-seq data, cell spatial locations, and cell division histories; studying regulatory mechanisms in cells during differentiation, development, or disease progression;. Integrating multi-modality data at the single cell level, including single cell RNA-Seq, spatial information of cells, chromatin accessibility, spatial information of cells, and cell division history obtained from lineage tracing technology. She teaches a graduate level course in Algorithms and will be supervising three PhD students as of Fall 2020.