James Forward

San Francisco, CA | james.forward@ucsf.edu | https://jcforward.github.io/

EDUCATION

B.Sc. Integrated Science (Microbiology and Cellular Physiology), with Distinction 09.2019 – 05.2024
Faculty of Science, **University of British Columbia (UBC)**, *Vancouver, BC*

- Dean's Honours List

PROFESSIONAL APPOINTMENT

University of California, San Francisco (UCSF), *San Francisco, CA* 01.2025 – *Present*
Junior Specialist, Cell and Tissue Biology
Advisor: Fred Chang and John Vaughen

I designed and am leading a study on how the circadian clock regulates the physical state of neurons in the Drosophila brain, focusing on daily oscillations in intracellular diffusion and membrane mechanics within clock-network neurons. Using genetically encoded multimeric nanoparticles (GEMs), I aim to perform live imaging and single-particle tracking in explanted fly brains to quantify cytoplasmic diffusivity in vivo with cell-type and subcellular resolution.

I have generated preliminary data that demonstrate that GEMs can be robustly expressed and tracked in the intact brain—marking one of the first applications of these probes in a multicellular context—and establish a novel platform to interrogate cytoplasmic rheology in vivo. I will perform complementary experiments with a proteostasis reporter to assess how diffusion dynamics influence protein turnover and aggregation, while the integration of optogenetic stimulation with RNAi-mediated knockdown of excitability regulators dissects the impact of neuronal firing on cytoplasmic states. These findings are poised to reveal early biophysical markers of circadian dysfunction and aging, with broad implications for understanding neurodegeneration.

University of California, San Francisco (UCSF), *San Francisco, CA* 08.2024 – *Present*
Junior Specialist, Cell and Tissue Biology
Advisor: Fred Chang

I am investigating how extracellular signals modulate the physical state of cells in *Saccharomyces Cerevisiae*, with a particular emphasis on the mating pheromone alpha factor. Although alpha factor is well known for inducing G1 cell cycle arrest and driving morphological changes in MATa cells as they prepare for mating, the biophysical mechanisms underlying these effects remain poorly understood. By using GEMs and particle tracking microscopy, I demonstrated that alpha-factor elicits a transient, dose-dependent increase in intracellular diffusion—a response that suggests a temporary fluidization of the cytoplasm. This increase inspired me to look more closely at the role of active cellular processes, as cycloheximide treatment partially reduced the diffusion enhancement, pointing to a potential involvement of protein synthesis or ribosomal dynamics.

My current investigations aim to determine whether these diffusion changes arise from a reduction in cytoplasmic crowding due to volumetric changes or from a reorganization of ribosomal content modulated via TOR signaling. Furthermore, I am dissecting the contribution of G1 cell cycle arrest to these cytoplasm changes. These work aims to provide insight on how signaling networks regulate the physical properties of the cytoplasm. This work has led to two talks and two poster presentations.

UCSF Anatomy & MIT Bioengineering, *San Francisco, CA and Cambridge, MA* 09.2024 - *Present*
Research Assistant
Advisors: John Vaughen and Cullen Buie

I am pioneering the development of an electroporation method to enable an efficient, scalable method to knockdown, mutate, or overexpress multiple genes at once in vivo with precise tissue specificity in adult Drosophila melanogaster. By increasing the efficiency of multigenic perturbations, this would allow novel screens and substantially reducing the barriers to studying complex processes coordinated by gene networks, including lipid metabolism, cell signaling transcriptional cascades, and polygenic disease alleles. I am a co-inventor on a licensed patent application based on this work.

UBC Zoology & Microbiology & Immunology, *Vancouver, BC* 02.2023 – *Present*
Undergraduate Thesis Student
Advisor: Kayla King

As my undergraduate thesis project, I conceived a project on how temperature affects bacterial morphogenesis and growth of *Leucobacter Musarum* (Verde2) over evolutionary time. Using a combination of single-cell imaging and computational modelling, I analyzed image stacks for changes in cell size. Further, I used population level growth dynamics to obtain metrics such as lag-phase and bacterial density to associate with levels of fitness or virulence. To confirm population level growth metrics, I performed time lapse microscopy and analyzed using pipeline 'Morphometrics' on MATLAB to quantify single cell growth rates. This work has led to one talk, two poster presentations, and one manuscript on which I am a co-author that is in review at *Nature*.

In parallel, I developed a method to engineer the lab's non-model bacterium, *Leucobacter sp.*, through a transposon-based plasmid. By manipulating Leucobacter to successfully express a fluorescent tag, this will enable the visualization of *Leucobacter*-host interactions and tracking of competition between evolved and ancestor populations.

UBC Zoology & Microbiology & Immunology, *Vancouver, BC* 01.2024 – 08.2024
Undergraduate Researcher
Advisor: Evelyn Sun

I led a project that investigated the role of inflammation and surgical intervention on the gut microbiome in Crohn's Disease. Utilizing a dataset with 16S ribosomal RNA sequencing data and fecal calprotectin measurements, we examined how inflammation and bowel resections affect the microbiome's composition and diversity. Using R and QIIME2, we identified potential indicator species in the microbiome of patients with and without surgical resection, and its association with levels of inflammation. This work had led to one publication on which I am a co-first author and one oral presentation.

UBC Zoology & Microbiology & Immunology, *Vancouver, BC* 09.2022 – 04.2023
Undergraduate Researcher
Advisor: Brett Finlay

I investigated *E. coli Nissle*'s probiotic qualities by studying the operational dynamics of its Type Six Secretion System (T6SS). To characterize effector proteins of the T6SS, we employed protein analysis suites to analyze domain function and the specificity of the protein to the secretion system. In addition to the dry lab component, I further tested the toxic effect of these proteins on the

periplasm compared to the cytoplasm using different localization signals bound to different genes of interest.

During my time in the Finlay lab, I also assessed the effect of various metabolic supplements on bacterial growth patterns. Through various growth measurements, I measured virulence factor and gene expression in response to environmental stimuli via bioluminescence reporter gene assays. To determine that bacterial gene expression, prompted by specific metabolites, could potentially lead to morphological changes in the gut, I performed histological examination of murine cecum tissues using microscopy and quantified images with ImageJ software.

LEADERSHIP EXPERIENCE

President, UBC Neuroscience Association (UNA) 04.2023 – 05.2024

- Led a team of 30 Execs to run an academic society of 500+ undergraduate students, which also partners with the UBC Neuroscience program to support students in the new Neuroscience major.
- Overseeing initiatives such as awards, career workshops, podcast, journal club, fundraisers, mentorship program, gala, social events
- Spearheaded the annual UBC Neuroscience Undergraduate Research Conference (>400 attendees). Through this conference, we give specifically undergraduate students a platform to present research they have been working on. The organization of the conference includes keynote speeches from faculty members, workshops, and oral/poster presentations.
- Co-created the Undergraduate Neuroscience Journal, in partnership with the UBC department of Neuroscience. The journal will publish capstone projects and abstracts from the Neuroscience Undergraduate Research Conference.
- Collaborated on grant applications and was awarded $18k+ for use in the 2023/24 academic year

Neuroscience Steering Committee, UBC Department of Neuroscience 04.2023 – 05.2024

- Working closely with the UBC Neuroscience department to contribute to the decision-making process and collaborative efforts that shape the direction and initiatives of the department.
- Collaborated with course developers and the director of the neuroscience program to design the undergraduate course: Neuroscience Capstone (NSCI 400)

Research Mentor, Undergraduate Research Opportunities (URO) 04.2022 – Present

- Dedicated 100+ hours of individualized mentorship of seven first- and second-year undergraduates. Developed and led hour-long biweekly workshops in topics such as professional development, finding undergraduate research opportunities, and networking.

Neuroscience Mentorship Program, UBC Department of Neuroscience 09.22 – Present

- Provided mentorship and leadership to 12 neuroscience undergraduate students based on the students' focus and goals
- Led a multi-day CV, cover letter and interview workshop, assisting one mentee in securing an internship at a biotechnology company, and two more in acquiring funded research experience in academic labs

VP External, UBC Neuroscience Association (UNA) 04.2022 – 05.2023

- Oversaw a team of 10+ students to organize external events for 150+ undergraduate attendees that focus on neuroscience-related careers, networking for students, professional development and community building.
- Contacted professors, healthcare workers, and sponsors; liaised with information to support our

events.
- Led weekly meetings to discuss upcoming events, promotions, administrative logistics and budget
- management.
- Designed and facilitated live events, including setting up and take down of venues, decorations and debriefing with staff.

Instructor, AllSet learning 05.2019 – 08.2023
- Taught high school science and math, AP biology, and AP chemistry.
- Collaborated with other coworkers to create lecture slides and problem sets.
- Filmed work examples to teach the students during the Covid lockdown

VOLUNTEER EXPERIENCE

BCIT teaching lab research volunteer 08.2019 – 11.2019
- Gained molecular genetic lab experience through running HF PCR, gel electrophoresis and ELISA tests.
- Learned basic microbiology techniques: plating for CFU enumeration, medium prep, and colony analysis.

Teacher Shadowing, Lord Byng Secondary 05.2022 – 02.2023
- Gained first-hand experience through classroom observations and discussion on management and teaching techniques.

Lord Byng First Responders team 11.2017 – 06.2019
- Worked on a two to three-person team each call, cooperated with my fellow members and executed the tasks and ensure the patient receives the most proper care.

Day Time Volunteer, Chown Adult Day Centre 07.2018 – 08.2019
- Observed and offered care for elderly with a variety of medical conditions while helping isolated seniors to socialize and communicate with others.

PUBLICATIONS

Journal Articles

1. Rising temperatures favour parasite virulence and parallel molecular evolution following a host jump
   Hector TH, Kreiner J, **Forward J**, Hoang K, Stevens E, Johnson S, Li J, King KC.
   bioRxiv (In review at *Nature*) DOI: 10.1101/2025.01.14.632940

2. Surgical intervention correlates with reduced bacterial diversity in the gut microbiome of Crohn's Disease patients exhibiting low levels of inflammation.
   Bremner M, Feng A, **Forward J**, Guan R, Zhang S. (2024).
   Undergraduate Journal of Experimental Microbiology, Peer Reviewed (UJEMI+)
   a. All authors contributed equally to project conception, experimentation, and writing.

AWARDS AND SCHOLARSHIPS

UBC Science Undergraduate Research Experience (SURE) Award, **$9,755** 05.2024
UBC AMS Nomination for Best Academic Club 04.2024
UBC Dean's Honour List 09.2019 - 05.2024

British Columbia Government Achievement Scholarship, **$1250** 09.2019
Award of Excellence, **$1250** 09.2019
BC First Responders Community Award, **$250** 09.2019

SELECTED TALKS

Mating Pheromone Induces Increased Cytoplasmic Diffusion In Budding Yeast
Forward J, Lemière J, F Chang

- Bay Area Cytoskeleton Symposium, San Francisco CA 04.2025
- 4th Annual Cell Size and Growth Meeting, Lake Tahoe CA 02.2025

Adaptation of Pathogens to Temperature Changes: Insights into Virulence and Morphological Plasticity
Forward J, McCallum G, Hector T, Tropini C, King K.

- Host-Parasite Supergroup Meeting, Vancouver BC 04.2024

Investigating the Role of Inflammation and Surgical Intervention on the Gut Microbiome in Crohn's Disease
Forward J, Bremner M, Feng A, Guan R, Zhang S.

- Microbiology Undergraduate Research Symposium, Vancouver BC 04.2024

POSTER PRESENTATIONS

Mating Pheromone Induces Increased Cytoplasmic Diffusion In Budding Yeast
Forward J, Lemière J, F Chang

- Bay Area Cytoskeleton Symposium, San Francisco CA 04.2025
- Cell Bio 2024, ASCB/EMBO Meeting, San Diego CA 12.2024

Warming mediates the genomic evolution of a tropical parasite (Leucobacter) after experimental introduction to a novel temperate nematode host.
Hector TH, Kreiner J, **Forward J**, Hoang K, Stevens E, Johnson S, Li J, King KC.

- British Ecological Society Annual Meeting 2024, Liverpool UK 12.2024

Adaptation of Pathogens to Temperature Changes: Insights into Virulence and Morphological Plasticity
Forward J,, McCallum G, Hector T, Tropini C, King K.

- Chan Zuckerburg Biohub, Physics of Life Symposium, San Francisco CA 09.2024
- Canadian Society of Ecology and Evolution 2024, Vancouver BC (unable to attend) 05.2024
- UBC Multidisciplinary Undergraduate Research Conference (MURC), Vancouver BC 03.2024