

# Fumiya Inaba

## Digital Pathology/Computational Medicine Researcher

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### Academics

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#### Master of Science Interdisciplinary Oncology

University of British Columbia | Guillaud Lab

May 2023 - May 2025 (Expected Graduation Date)

- With guidance from Dr.Martial Guillaud and Dr.MacAulay, studying digital pathology, with an emphasis in various supervised and unsupervised machine learning/deep learning algorithms to analyze medical image data.
- Current research work involves image analyses of prostate needle biopsies, unsupervised clustering to identify cell subtypes, exploratory data analyses to find correlations of certain cell subtypes to clinical outcome.

#### Bachelors of Medical Laboratory Sciences

University of British Columbia

Sept 2018 - May 2022

- Courses in general pathology, normal human histology, histochemistry, biochemistry, research methodologies

##### Relevant Courses:

Diagnostic Histochemistry (PATH 404)

- Designed and ran histochemical experiments to explore biochemistry of various tissue sections and analyzed/rationalized anomalous/unexpected results

Normal Human Histology (PATH 304)

- Examined tissue architecture and key cell types of various tissue on histological slide sections and their relation to human physiology

Background to Medical Laboratory Science (PATH 300)

- Background to histochemical stains and techniques with hands-on tissue staining labs
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### Work Experience

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#### Research Assistant

MacAulay Lab, Integrative Oncology, BC Cancer Research Centre

Sept 2022 - May 2023

- Enhanced the performance of a nuclei segmentation deep learning model, specifically tailored for prostate biopsy slides.
- Developed and implemented a more memory-efficient data input pipeline for model retraining using TensorFlow Dataset API, significantly increasing the number of training images available per epoch from approximately 40,000 to over 100,000.
- Explored and implemented an advanced analysis pipeline utilizing unsupervised clustering algorithms, enabling accurate prediction of the risk of PSA-based biochemical recurrence of prostate cancer in patients.

#### Summer Student

Guillaud Lab, Integrative Oncology, BC Cancer Research Centre

July 2022 - Sept 2022

- Utilized TensorFlow and Apple's CreateML frameworks to differentiate stroma and epithelium in hematoxylin and eosin stained tissue, employing advanced image classification techniques.
- Developed automated tools in Python to efficiently sort, label, and annotate large volumes of image data, while also training TensorFlow/CreateML image classifier models.
- Collaborated in the annotation and creation of binary masks for 400 images, used to train a deep learning semantic segmentation model, utilizing MATLAB scripts.

#### Work-learn Student Columbia

Hallam Lab, Microbiology and Immunology, University of British Columbia

Sept 2021 - May 2022

- Conducted molecular laboratory experiments, including DNA/protein extractions, gel electrophoresis, and restriction digests, to validate 10 designed construct plasmids encoding nitrous oxide reductase and its accessory proteins.
- Cultivated transformed E. coli cells containing plasmids encoding accessory proteins and enzymes involved in the denitrification pathway of various microbial species.
- Employed Python scripts and SnapGene Viewer to compare plasmid digests on agarose gels, ensuring accurate verification of plasmid sequences.
- Performed comparative analysis of PAGE gels between wild-type BL21 cells and transformed cells after IPTG induction, confirming successful plasmid gene expression.

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## Research Experience

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### DNA Nanostructure Design Team Leader

UBC Biomolecular Design (BIOMOD)

Oct 2019 - Oct 2022

- Led a team in designing two hinge-like DNA origami nanostructures and a mechanism utilizing toehold-mediated strand displacement to lock the structures at desired angles, employing caDNA2.
- Analyzed the stability and probability of successful in-vitro formation of designed DNA origami nanostructures through comprehensive examination of simulation models and metrics, including root mean square fluctuations (RMSF) computed by multiple simulation programs such as CanDo, MrDNA, and NUPACK.
- Enhanced the team's design workflow by developing and implementing a Python program that visualizes potentially unfavorable strand connections on the caDNA2 user interface, ensuring robust design outcomes.
- Played a pivotal role in the iterative pipeline for the design and validation of DNA origami nanostructures, contributing to the team's success.
- Successfully led the nanostructure design team for 3 years, overseeing task delegation and verification, managing project timelines, and fostering effective communication with other subteams within the BIOMOD research team.
- Trained 7 team members on the usage of design software tools and imparted comprehensive knowledge of DNA origami concepts.

### Directed Studies Student

Côté Lab, Pathology and Laboratory Medicine, University of British Columbia

Sept 2021 - May 2022

- Established a standard curve to accurately quantify hypermethylated gene copies in a clinical sample by conducting qPCR assays on serial dilutions of cloned plasmids.
- Designed specific primers for the amplification of a gene promoter, utilized in both traditional and quantitative PCR, leveraging NCBI Primer BLAST for primer design.
- Cultivated and transformed E. coli cells with plasmids containing PCR product fragments used to construct the standard curve for gene copy quantification.
- Thesis: *Optimization of a Methylation-Specific qPCR Assay for Cell-Free Fetal DNA Quantification in Maternal Plasma*

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## Achievements | Awards

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### International Biomolecular Design Competition

BIOMOD Japan

September 2022

- Achieved 1st place overall in the prestigious International Biomolecular Design competition hosted by BIOMOD Japan in 2022.
- Demonstrated the potential utility of extendable DNA Hinge systems in the development of 'reusable' bioassays, significantly reducing the plastic waste generated by rapid antigen COVID testing kits.
- Explored the ethical, legal, and social implications associated with the introduction of these innovative technologies, highlighting their potential impacts.
- Contributed to the project's success as part of the UBC BIOMOD research team. Further details and contributions can be found at the project contributions link.
- Link to project contributions: <https://www.ubcbiomod.com/2022/structure-design/>

### NSERC USRA - Work Learn

Hallam Lab, Microbiology and Immunology, University of British Columbia

September 2021 - May 2022

- Awarded the prestigious NSERC Undergraduate Student Research Award (USRA) to work as a part of the Hallam Lab in a work-learn capacity from September 2021 to May 2022.
- Conducted research under the guidance of the Hallam Lab team, actively contributing to ongoing projects and scientific advancements.

### ECOSCOPE Undergraduate Research Award (EURA)

ECOSCOPE/Hallam Lab

January 2022

- Received the ECOSCOPE Undergraduate Research Award (EURA), a research grant of \$1000, to support essential expenses related to participation in the UBC BIOMOD research team.

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## Skills

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### Software and Coding

- Python (3 years) - data science and image analysis (NumPy, pandas, scikit-learn, scikit-image, tensorflow, SciPy, Cython, PIL)
- R (~1 year) - data science (tidyverse, tidymodels, randomForest)
- Jupyter with IPython/IR kernels
- git/GitHub
- WSL2/Linux

### Laboratory

- Histochemistry lab skills (1 year) - staining, imaging, slide analysis
  - Molecular biology lab skills (2 years) - DNA molecular biology work (PCR, qPCR, DNA origami formation, plasmid cloning etc.)
  - Microbiology lab skills (2 years) - liquid culture, plating, culture transformation, DNA/protein extraction
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## Publications

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1. Law, M., Susham, C., Mackay, D., Nguyen, S., Nicholas, R., Tsai, M. R., Rajkumar, E., Inaba, F., Maheden, K., Abdi, I., Ho, J. C. H., Kieft, B., & Hallam, S. J. (2023). Self-assembly of a repeatable DNA Nanohinge system supporting higher order Structure Formation. *Biorxiv*. <https://doi.org/10.1101/2023.05.26.542516>
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## Skill Development/Certificates

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### Python 3 Programming Specialization

University of Michigan, Coursera

- Course (1 of 5) - Python Basics (Complete)
- Course (2 of 5) - Python Functions, Files, and Dictionaries (Complete)
- Course (3 of 5) - Data Collection and Processing with Python (Complete)
- Course (4 of 5) - Python Classes and Inheritance (Complete)
- Course (5 of 5) - Python Project: pillow, tesseract, and opencv (Complete)

### Machine Learning Specialization

Stanford University/DeepLearning.AI, Coursera

- Course (1 of 3) - Supervised Machine Learning: Regression and Classification (Complete)
- Course (2 of 3) - Advanced Learning Algorithms (Complete)
- Course (3 of 3) - Unsupervised Learning, Recommenders, Reinforcement Learning (in-progress)