

# Madeleine S. Gastonguay

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## Education

**University of Connecticut**, Storrs, CT

May 2020

Bachelor of Science, Applied Mathematics

Summa Cum Laude with Honors; GPA: 3.98/4.00

Minor: Bioinformatics

Thesis: A Quantitative Pipeline for The Identification of Combinations of Targets

for Claudin-Low Triple Negative Breast Cancer Reversion

Advisor: Dr. Paola Vera-Licona

**La Sorbonne University**, Paris, France

January 2018 - May 2018

Course de Civilisation Française

## Research Experience

**The Jackson Laboratory (JAX)**, Bar Harbor, ME

June 2020 - present

*Research Data Analyst I*

Topic: A Bayesian approach to mediation analysis of complex traits with measurement noise

- Contributed to the development and validation of an R package implementation of a Bayesian model selection approach to mediation analysis that is flexible in both data inputs and potential inferences, and extended it to moderated mediation
- Diagnosed the effect of measurement noise on the inference of mediation
- Applied these tools to better understand the mechanisms underlying the effects of sex and diet on protein and gene expression in the livers of genetically diverse mice

**UConn Health Center for Quantitative Medicine**, Farmington, CT

September 2018 - May 2020

*Undergraduate Research Assistant*

Topic: A quantitative pipeline for cancer reversion analysis in triple negative breast cancer

- Constructed a static intracellular signaling network for a claudin-low triple negative breast cancer (CL TNBC) cell line with multi-omics data using bioinformatics techniques
- Applied a structure-based control method for nonlinear systems, implemented in python, to identify putative targets that steer the system to any desired attractor
- Conducted virtual screenings using a network-based approach and a signal propagation algorithm to estimate long term behaviors to identify concerted perturbations of control nodes resulting in reversion of the CL TNBC phenotype

**Metrum Research Group**, Simsbury, CT

June 2018 - August 2018

*Summer Intern*

Topic: A maternal-fetal physiologically based pharmacokinetic model for drugs metabolized by cytochrome P450 isoenzymes

- Modeled maternal and fetal drug exposures at varying gestational ages by incorporating anatomical, biochemical, and physiological changes associated with pregnancy as a system of ordinary differential equations using R and *mrgsolve*
- Performed local sensitivity analysis, optimized model parameters, and validated the model by comparing model predictions to external published data

**University of Connecticut**, Department of Molecular and Cellular Biology, Storrs, CT

January 2017 - September 2017

*Undergraduate Research Assistant/Holster Scholar*

Topic: The effect of host genetic variability on Epstein Barr Virus (EBV)-associated cancer susceptibility

- Reviewed relevant literature to identify genes that may impact EBV-associated cancer susceptibility
- Used wet lab techniques such as Polymerase Chain Reactions, Gel Electrophoresis, and Sanger Sequencing to sequence the genes of interest in several EBV-associated cancer cell lines and a non-cancerous EBV+ control cell line
- Aligned the genetic sequence of target genes to identify common and distinct single nucleotide polymorphisms (SNPs) across EBV-associated cancer cell lines using the software Geneious and BLAST

**Children's Hospital of Philadelphia**, Philadelphia, PA, **Metrum Research Group**, Simsbury, CT

September 2015 - August 2016

*High School Independent Study*

Topic: A pharmacogenomic study of midazolam and morphine clearance in critically ill pediatric patients

- Analyzed variability of SNPs in the sample dataset for inclusion in the analysis
- Estimated the effect of pediatric risk of mortality score on drug clearance using population pharmacokinetic modeling
- Identified a SNP in UGT2B7 whose minor allele frequency is associated with increased midazolam clearance

## Publications and Preprints

Crouse, W. L., Keele, G. R., Gastonguay, M. S., Churchill, G. A., & Valdar, W. (2021). A Bayesian model selection approach to mediation analysis. *BioRxiv*, 2021.07.19.452969. <https://doi.org/10.1101/2021.07.19.452969>

Utsey, K., Gastonguay, M. S., Russell, S., Freling, R., Riggs, M. M., & Elmokadem, A. (2020). Quantification of the Impact of Partition Coefficient Prediction Methods on Physiologically Based Pharmacokinetic Model Output Using a Standardized Tissue Composition. *Drug Metabolism and Disposition*, 48(10), 903 LP – 916. <https://doi.org/10.1124/dmd.120.090498>

Zuppa, A. F., Benitez, G. R., Zane, N. R., Curley, M. A. Q., Bradfield, J., Hakonarson, H., Gastonguay, M. S., Moorthy, G., Prodell, J., & Gastonguay, M. R. (2019). Morphine Dose Optimization in Critically Ill Pediatric Patients With Acute Respiratory Failure. *Critical Care Medicine*, 47(6), e485–e494. <https://doi.org/10.1097/CCM.0000000000003741>

Zuppa, A. F., Conrado, D. J., Zane, N. R., Curley, M. A. Q., Bradfield, J., Hakonarson, H., Gastonguay, M. S., Moorthy, G., Prodell, J., & Gastonguay, M. R. (2019). Midazolam Dose Optimization in Critically Ill Pediatric Patients With Acute Respiratory Failure. *Critical Care Medicine*, 47(4), e301–e309. <https://doi.org/10.1097/CCM.0000000000003638>

## Manuscripts in Preparation

Gastonguay, M. S., Keele, G. R., & Churchill, G. A. (2021). The impact of measurement noise in mediation analysis.

## Oral Presentations

Gastonguay MS, Russell S, Freling R, Utsey K, and Elmokadem A, *Prediction of maternal-fetal exposures of CYP450-metabolized drugs using physiologic pharmacokinetic modeling implemented in R and mrgsolve.*, R/Pharma Conference, Cambridge, MA, August 23<sup>rd</sup>, 2019

Gastonguay MS, Marazzi L, Vera-Licona P, *Identification of Combinations of Targets for Claudin-Low Triple Negative Breast Cancer Reversion*, UConn Center for Quantitative Medicine, July 30<sup>th</sup>, 2019

Gastonguay MS, Marazzi L, Vera-Licona P, *Identification of Combinations of Targets for Claudin-Low Triple Negative Breast Cancer Reversion*, UConn Center for Cell Analysis and Modeling Summer Seminar, July 26<sup>th</sup>, 2019

Gastonguay MS, Russell S, Freling R, Utsey K, and Elmokadem A, *Development of an Open and General Physiologically Based Pharmacokinetic Model to Predict Maternal-Fetal Exposures for Drugs Metabolized by CYP Isoenzymes*, R/Medicine Conference, New Haven, CT, September 8<sup>th</sup>, 2018

Gastonguay MS, *The Effect of Host Genetic Variability on Epstein Barr Virus-associated cancer susceptibility*, UConn Holster Scholar Symposium, October 2017

## Poster Presentations

Gastonguay MS, Marazzi L, Vera-Licona P, *Identification of Combinations of Pharmacologic Targets for Claudin-Low Triple Negative Breast Cancer Reversion*, International Society of Pharmacometrics Quantitative Systems Pharmacology Student Symposium, Virtual, April 28<sup>th</sup>, 2021

Gastonguay MS, Marazzi L, Vera-Licona P, *Identification of Combinations of Targets for Claudin-Low Triple Negative Breast Cancer Reversion*, Joint Meeting in Mathematics, Denver, CO, January 15<sup>th</sup> – 18<sup>th</sup>, 2020

Gastonguay MS, Russell S, Freling R, Utsey K, and Elmokadem A, *Development of an Open-source Physiologically-Based Pharmacokinetic Model to Predict Maternal-Fetal Exposures of CYP450-Metabolized Drugs*, International Society of Pharmacometrics Regional Quantitative Systems Pharmacology Day, Princeton, NJ, July 16<sup>th</sup>, 2019

Gastonguay MS, Russell S, Freling R, Utsey K, and Elmokadem A, *Development of an Open-source Physiologically-Based Pharmacokinetic Model to Predict Maternal-Fetal Exposures of CYP450-Metabolized Drugs*, University of Connecticut Frontiers in Undergraduate Research, April, 2019

## Fellowships and Grants

**Summer Undergraduate Research Fund**, University of Connecticut Office of Undergraduate Research May 2019

- Awarded funding for a 9-week summer research project

**Holster Scholar**, University of Connecticut Honors Program May 2017

- Offered enrollment in a semester-long course to learn how to develop and write a project proposal
- Selected as one of 8 students awarded funding for a 10-week summer research project

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## Honors and Awards

<b>Blue Ribbon Poster Award</b> , ISoP Quantitative Systems Pharmacology Student Symposium	April 2021
<b>Dean's List</b> , The University of Connecticut	Sept. 2016 - May 2020
<b>Academic Excellence Scholarship</b> , The University of Connecticut	Sept. 2016 - May 2020
<b>Babbidge Scholar</b> , The University of Connecticut	Dec. 2017, 2019
<b>New England Scholar</b> , The University of Connecticut	Dec. 2018
<b>Global Citizenship Scholarship</b> , The University of Connecticut Education Abroad	Jan. 2017

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## Skills & Certifications

**Technical:** R; Python; basic Matlab, SQL, Julia, and bash shell; Git; LaTeX; OpenRefine; High Performance Computing with SLURM; *mrgsolve*; *shiny*; *tidyverse*; *plotly*; JAGS; Bayesian Data Analysis

**Wet Lab:** Polymerase Chain Reactions, Gel Electrophoresis, Gel Extraction, Sanger sequencing

**Language:** Proficient in French conversation, reading, and writing; Certified in French level B1.2 by La Sorbonne in Paris

**Teaching:** Certified Instructor with The Carpentries

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## Teaching Experience (\* indicates upcoming)

<b>Data Carpentry Ecology with R Workshop*</b> , Bioinformatics Training Program at JAX (Instructor)	Dec. 2021
<b>Data Carpentry Genomics Workshop</b> , Bioinformatics Training Program at JAX (Instructor)	Nov. 2021
<b>Introductory Statistics with R</b> , Bioinformatics Training Program at JAX (TA)	Sept. 2021
<b>Introduction to R and RStudio</b> , Bioinformatics Training Program at JAX (TA)	June 2021

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## Professional Development and Continuing Education

<b>Building Tidy R Packages</b> , R/pharma 2021	Oct. 2021
<b>Julia Language for R Programmers</b> , R/pharma 2021	Oct. 2021
<b>Advanced Shiny</b> , RStudio	Sept. 2021
<b>Introduction to Bayesian Data Analysis</b> , Juliacon	July 2021
<b>Carpentries Instructor Training</b> , The Carpentries	Mar. 2021
<b>Shiny, RMarkdown, and RStudio Connect</b> , RStudio	Mar. 2021
<b>Quantitative Trait Mapping in the Diversity Outbred</b> , University of Wisconsin-Madison	Dec. 2020
<b>Containerization with Singularity</b> , JAX	Oct. 2020
<b>Introduction to HPC</b> , JAX	Sep. 2020
<b>Human and Mammalian Genetics and Genomics: The 61<sup>st</sup> McKusick Short Course</b> , JAX	July 2020
<b>Shiny Reproducibility</b> , R/pharma 2019	Aug. 2019
<b>Machine Learning</b> , R/pharma 2019	Aug. 2019

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## Professional Associations

Society for Industrial and Applied Mathematics (SIAM)  
International Society of Pharmacometrics (ISoP)  
American Statistics Association (ASA)

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## Volunteer Work and Extra-Curricular Activities

<b>Rubyfruit A Cappella</b> , The University of Connecticut	Sept. 2016 - May 2020
<ul style="list-style-type: none"><li>Elected as President (2019-2020), Assistant Music Director (2018 - 2019), and Treasurer (2017- 2018)</li><li>Coordinated funding, schedules, and rehearsals to record an album and distribute it on Spotify and Apple Music</li><li>Communicated with other executive board members to run productive fundraisers, rehearsals, and gigs</li></ul>	
<b>Math Motivators</b> , The University of Connecticut	Oct. 2017 - May 2019
<ul style="list-style-type: none"><li>Tutored high school freshmen from underprivileged schools in Hartford, CT</li></ul>	
<b>iGEM Genetic Engineering Team</b> , The University of Connecticut	Sept. 2016 - Dec. 2017
<ul style="list-style-type: none"><li>Developed and presented a project proposal for the iGEM jamboree with a team of students</li></ul>	