# 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 mechanism underly 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

- Awarded a Summer Undergraduate Research Fund through UConn to fund work
- 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 the topology of the network and a signal propagation algorithm to identify concerted perturbations of control targets resulting in reversion of the CL TNBC phenotype

**Metrum Research Group**, Simsbury, CT — June - August 2018
Summer Intern
Topic: An open and general maternal-fetal physiologically-based pharmacokinetic model for drugs metabolized by cytochromes 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 - September 2017
Undergraduate Research Assistant/Holster Scholar
Topic: The effect of host genetic variability on Epstein Barr Virus (EBV)-derived cancer susceptibility

- Reviewed relevant literature to identify genes that may impact EBV-derived 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-derived 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 across EBV-derived cancer cell lines using the software Geneious and BLAST

## 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 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

## Manuscripts in Preparation

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

**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

**Selected 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 23rd, 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 26th, 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 8th, 2018

**Selected 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 28th, 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 15th – 18th, 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 16th, 2019

**Honors and Awards**

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| **Blue Ribbon Poster Award,** ISoP Quantitative Systems Pharmacology Student Symposium | April 2021 |
| **Dean's List**, The University of Connecticut | Sept. 2016 - May 2020 |
| **Academic Excellence Scholarship**, The University of Connecticut | Sept. 2016 - May 2020 |
| **Babbidge Scholar**, The University of Connecticut | Dec. 2017, 2019 |
| **New England Scholar**, The University of Connecticut | Dec. 2018 |

**Skills & Certifications**

**Technical:** R; basic Python, 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

**Teaching Experience** (* indicates upcoming)

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

**Volunteer Work and Extra-Curricular Activities**

**Math Motivators,** The University of Connecticut — Oct. 2017 - May 2019
- Tutored high school freshmen from underprivileged schools in Hartford, CT

**iGEM Genetic Engineering Team,** The University of Connecticut — Sept. 2016 - Dec. 2017
- Developed and presented a project proposal for the iGEM jamboree with a team of students

**Rubyfruit A Cappella,** The University of Connecticut — Sept. 2016 - May 2020
- Elected as President (2019-2020), Assistant Music Director (2018 - 2019), and Treasurer (2017- 2018)