

NOOR YOUSSEF

nooryoussef03@gmail.com

Systems Biology ◊ Harvard Medical School ◊ Broad Institute of Harvard and MIT

nooryoussef.github.io

EMPLOYMENT

Scientific lead, Predictive Modeling for Vaccine Design

March 2023 - current

Debora Marks Lab, Systems Biology, Harvard Medical School

Machine Learning Fellow

Sept 2021 - March 2023

Debora Marks Lab, Systems Biology, Harvard Medical School

EDUCATION

PhD, Computational Biology

2015 - 2021

Dalhousie University

Title: Evolutionary dynamics under a stability-constrained model

Advisor: Dr. Joseph Bielawski, Dept. Biology and Dept. Mathematics & Statistics

Advisor: Dr. Edward Susko, Dept. Mathematics & Statistics

BSc, Combined Honours in Mathematics & Biology

2011 - 2015

Dalhousie University

Title: Addressing the Impacts of Non-stationary Evolution on Selection Pressure Inference.

First Class Honours

PUBLICATIONS IN REVIEW

11. Yu Y, Kass MA, Zhang M, **Youssef N**, Freije CA, Brock KP, Seifert LL, Venkittu S, Hong X, Shlomai A, de Jong YP, Marks DS, Rice CM^c, Schneider WM^c (2023). Deep mutational scanning of HBV reveals a mechanism for cis preferential reverse transcription. *In review. Cell*.

PUBLICATIONS

First author: 4, Second author: 4, Corresponding author: 4

Co-first ^{*}, Corresponding ^c

10. Thadani NT^{*}, Gurev S^{*}, Notin P^{*}, **Youssef N**, Rollins NJ, Sander C A, Gal Y, and Marks D^c (2023). Learning from pre-pandemic data to forecast viral antibody escape. *In press. Nature*.

9. **Youssef N**^c, Susko E, Roger A, and Bielawski JP (2022). Evolution of amino acid propensities under stability-mediated epistasis. *Molecular Biology and Evolution*, 39(3): msac030.

8. **Youssef N**^c, Susko E, Roger A, and Bielawski JP (2021). Shifts in amino acid preferences as proteins evolve: a synthesis of experimental and theoretical work. *Protein Science*, 30(10): 2009-2028.

7. Stewart DR, Robicheau BM, **Youssef N**, Garrido-Ramos MA, Chase EE, and Breton S^c (2021). Expanding the search for sperm transmission elements in the mitochondrial genomes of bivalve mollusks. *Genes*, 12(8): 1211.

6. **Youssef N**^c, Susko E, and Bielawski JP (2020). Consequences of stability-induced epistasis for substitution rates. *Molecular Biology and Evolution*. 37(11): 3131-3148.

5. Jones CT^c, **Youssef N**, Susko E, and Bielawski JP (2020). A Phenotype–Genotype Codon Model for Detecting Adaptive Evolution. *Systematic Biology*, 69(4): 722–738.
4. Stewart DR^c, Breton S, Chase EE, Robicheau BM, Bettinazzi S, Pante E, **Youssef N**, and Garrido-Ramos MA (2020). An unusual evolutionary strategy: the origins, genetic repertoire, and implications of doubly uniparental inheritance of mitochondrial DNA in bivalves. In: Pontarotti P (eds) *Evolutionary Biology—A Transdisciplinary Approach*. Springer, Cham.
3. **Youssef N**^c, Budd A, and Bielawski JP (2019). Introduction to genome biology and diversity. In: Anisimova M. (eds) *Evolutionary Genomics. Methods in Molecular Biology*, vol 1910. Humana, New York, NY.
2. Jones CT^c, **Youssef N**, Susko E, and Bielawski JP (2018). Phenomenological load on model parameters can lead to false biological conclusions. *Molecular Biology and Evolution*, 35: 1473–1488.
1. Jones CT^c, **Youssef N**, Susko E, and Bielawski JP (2017). Shifting balance on a static mutation-selection landscape: a novel scenario of positive selection. *Molecular Biology and Evolution*, 34: 391–407.

FUNDING AND AWARDS

Gray-Doolittle Award for Research Excellence <i>Institute of Comparative Genomics (ICG)</i>	2022
Award for Best Presentation in Symposium <i>12th Annual Dr. Patrick Lett Research Symposium.</i>	2019
Award for Best Session Presentation <i>12th Annual Dr. Patrick Lett Research Symposium.</i>	2019
Featured Scientist <i>Center for Comparative Genomics and Evolutionary Bioinformatics</i>	2018 - 2019
Featured Scientist in-lecture interview <i>Cell Biology</i>	2019
Graduate Student Award <i>Center for Comparative Genomics and Evolutionary Bioinformatics</i>	2017
Graduate Student Travel Grant <i>Dalhousie Association of Graduate Students, Dalhousie University</i>	2017
Student Grant <i>Dalhousie Student Union, Dalhousie University</i>	2017
Biology Graduate Student Fellowship <i>Dalhousie University</i>	2015 - 2021
Entrance Scholarship for Academic Excellence <i>Dalhousie University</i>	2011 - 2015

TEACHING EXPERIENCE

Co-Creator and Instructor Course: Calling Baloney - The Art of Questioning Data <i>Nashua Street Jail, The Educational Justice Institute, MIT.</i>	Oct 2022 - Sept 2022
Teaching Assistant Course: Introduction to Computation and Programming Using Python <i>The Educational Justice Institute, MIT.</i>	April 2022 - May 2022

Tutorial Instructor Course: Genetics <i>Second Year Undergraduate Course, Dalhousie University.</i>	<i>Sept 2016 - May 2020</i>
Guest Lecturer Course: Genetics <i>Second Year Undergraduate Course, Dalhousie University.</i>	<i>Sept 2017 - May 2019</i>
Creator and Instructor Course: Inference of natural selection pressure in protein coding DNA sequences <i>Graduate-Level Course, Dalhousie University.</i>	<i>Jan 2018 - May 2018</i>
Guest Lecturer Course: Molecular Evolution <i>Third Year Undergraduate Course, Dalhousie University.</i>	<i>Sept 2017 - Dec 2017</i>
Lab Teaching Assistant Course: Genetics <i>Second Year Undergraduate Course, Dalhousie University.</i>	<i>Sept 2015 - May 2016</i>
Lab Teaching Assistant Course: General Chemistry <i>First Year Undergraduate Course, Saint Mary's University.</i>	<i>Sept 2012 - May 2013</i>

CONFERENCE PRESENTATIONS

Forecasting viral escape from neutralizing antibodies using machine learning, *World Vaccine Congress, Washington DC. 2023.*

Predicting viral antibody escape: An integrated computational and experimental approach. *Dept Systems Biology, Harvard Medical School. 2022.*

Iterative computational modeling and assays for infectivity and antibody neutralization to predict SARS-CoV-2 potential for vaccine escape. *Coalition for Epidemic Preparedness Innovations. 2022.*

Identifying host targets for panviral therapeutic interventions. *HMS-AbbVie. 2022.*

Consequences of stability-induced epistasis on theoretical and inferred substitution rates. *SMBE. 2020.*

The influence of epistasis on substitution rates. *Institute of Comparative Genomics. 2019.*

Implications of Epistasis on Protein Evolution: A Thermodynamically Guided Walk Through Sequence Space. *Dr. Patrick Lett Research Symposium. 2019.*

A thermostability-informed model of protein evolution: The Good, the Bad, and the Ugly. *Center for Comparative Genomics and Evolutionary Bioinformatics. 2018.*

The implied differences in evolutionary dynamics between intragenic epistasis and site-independence modelling *Dr. Patrick Lett Research Symposium. 2018.*

Evolutionary trajectories in protein space. *Center for Comparative Genomics and Evolutionary Bioinformatics. 2017.*

Assessing methods for detecting adaptive peak shifts from comparative codon data. *Dr. Patrick Lett Research Symposium. 2016.*

Codon Substitution Models are ill-equipped to deal with non-stationary evolution. *Dr. Patrick Lett Research Symposium.* 2015.

Analysis of the *Prochlorococcus* *cpeβ* gene to determine the effects of non-stationary evolution on the inference of selection pressure. *Cameron Conference.* 2015.

ACADEMIC SERVICE

Peer-Reviewer

Nature Communications, Nature Machine Intelligence, Molecular Biology and Evolution, Genome Biology and Evolution, Journal of Molecular Evolution, BMC Evolutionary Biology

Organiser, Evolution and Philosophy Discussion Group 2018 - 2020
Dalhousie University

Search Committee for the Jarislowsky Chair in Marine Ecosystem Forecasting 2019
Dalhousie University

Vice-President 2019 - 2020
Biology Organization of Graduate Students, Dalhousie University

Event Coordinator, BioBall 2019 - 2020
Biology Organization of Graduate Students, Dalhousie University

Trainee 2015 - present
Center for Comparative Genomics and Evolutionary Bioinformatics

Member, Evolutionary Studies Group 2016 - present
Dalhousie University

Social Coordinator 2017 - 2019
Biology Organization of Graduate Students, Dalhousie University

Volunteer, Lett Symposium 2016- 2018
Dalhousie University

Treasurer 2016 - 2017
Biology Organization of Graduate Students, Dalhousie University

MENTORSHIP

PhD Students

Sarah Gurev, Massachusetts Institute of Technology (MIT)
Ralph Estanboulieh, Harvard Medical School
Abigail Jackson, Harvard Medical School

Masters Students

Hannah Pierce-Hoffman, Harvard Medical School

Research Associates

Daniel Ritter, Harvard Medical School
Ben Kotzen, Massachusetts General Hospital
Rachel Liang, Massachusetts General Hospital
Emory Abar, Massachusetts General Hospital

Undergraduate Students

Steven Nguyen, Dalhousie University

WORKSHOPS AND EXTRA-CURRICULAR COURSEWORK

Parallel Computing Summer School. *Compute Canada.* 2020.

Programming Numerical Methods in Python. *Udemy.* 2020.

Online Synchronous Teaching workshop *The Centre for Learning and Teaching, Dalhousie University.* 2020.

Darwinizing Gaia. *Center for Comparative Genomics and Evolutionary Bioinformatics, Dalhousie University.* 2019.

Evolutionary Roles of Transposable Elements and ‘non-coding’ DNA: the Science and the Philosophy Workshop. *Dalhousie University.* 2018.

Philosophy of Biology Workshop. *Dalhousie University.* 2018.

RELEVANT COURSEWORK

Graduate Courses:

Stochastic Processes. Bioinformatics. Algorithms in Bioinformatics. Communication Skills-Scientist.

Biology Undergraduate Courses:

Evolution. Genetics. Molecular Evolution.

Mathematics Undergraduate Courses:

Matrix Theory/Linear Algebra (I and II). Cryptography. Theory of Numbers. Game Theory.

PROGRAMMING SKILLS

○ Python ○ R ○ Matlab ○ Shell ○ L^AT_EX

STUDENT COMMENTS

Teaching Evaluations from 2nd-year Genetics Tutorial

2016 - 2020

“The best TA I have had in university. She explained things extremely clearly and offered different approaches to problems. Attending this tutorial with Noor was a critical part of doing well in this course and grasping material.”

“Noor was amazing! So knowledgeable on the subject, amazing at explaining everything. I can really tell that the subject matter really resonates with Noor. Great at answering questions and checking in if we all understand. Very personable and approachable”

“Noor was clearly very well prepared for each genetics tutorial. She would make a really great professor or lab instructor one day!”

“Noor was very knowledgeable and I was impressed with how prepared she was for tutorial every week and really taught the material well. I did a lot better on the quizzes because of how well Noor could explain the subject.”

“I was lucky to have such an awesome and helpful TA!”

REFERENCES

Dr. Joseph Bielawski

j.bielawski@dal.ca

Department of Biology

Department of Mathematics & Statistics

Dalhousie University

Dr. Edward Susko

edward.susko@dal.ca

Department of Mathematics & Statistics

Dalhousie University

Dr. Debora Marks

debbie@hms.harvard.edu

Department of Systems Biology

Harvard Medical School

Broad Institute of Harvard and MIT

Dr. Andrew Roger

andrew.roger@dal.ca

Department of Biochemistry & Molecular Biology

Dalhousie University