

Elan Ness-Cohn

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EDUCATION

Ph.D. (Biomedical Research)

Northwestern University, Evanston

2022

Dissertation: *Topology Inspired Methods for the Design and Analysis of Transcriptomic Time-Series Data in Circadian Biology Research*

Advisor: Prof. R. Braun, Molecular Biosciences (Comp. Bio and Applied Math Group)

Graduate Certificate in Teaching

Northwestern Searle Center for Advancing Learning and Teaching

2021

B.Sc. (Biology), Concentration (Education)

Massachusetts Institute of Technology, Cambridge

2017

Thesis: *Regenerative Medicine and Synthetic Biology: Working Toward the Clinic*

Research Advisor: Prof D. Kim, Biology (Genetics Group)

Research Advisor: Prof R. Jaenisch, Biology (Stem Cell Group)

EXPERIENCE

Braun Lab

Ph.D. Candidate, Northwestern University

2017–2022

Topology Inspired Methods for the Design and Analysis of Transcriptomic Time-Series Data in Circadian Biology Research

- Developed a suite of open-source software packages for optimizing the design and analysis of *omic time-series experiments in circadian biology research.
- Developed novel reference-free, non-parametric methods using principles from dynamical system theory, topological analysis, and inferential statistics to identify circadian genes with chronotherapeutic potential.
- Lead multiple collaborative projects with peers leveraging inter-disciplinary expertise to investigate hypotheses and problem-solve obstacles.
- Mentored undergraduate and graduate students through various computational research techniques and organizational skills.

Jaenisch Lab

Undergraduate Research Assistant, Massachusetts Institute of Technology

2016–2017

Engineering Human Pluripotent Stem Cells With Insulin Reporter to Model Type 1 Diabetes

- Designed/cloned fusion gene plasmid and accompanying CRISPR/Cas9 guide RNAs for targeted tagging of gene of interest
- Supported in the *in vitro* differentiation of pluripotent stem cells to insulin producing beta-like cells

Kim Lab

Undergraduate Research Assistant, Massachusetts Institute of Technology

2015–2016

Regulation of Stress Physiology and Longevity by the EIF3 Translation Initiation Complex in C. Elegans

- Designed/cloned fusion gene plasmid and accompanying CRISPR/Cas9 guide RNAs for targeted tagging of gene of interest
- Generated CRISPR/Cas9 transgenic lines of *C. Elegans* through microinjection

COMPUTATIONAL & TECHNICAL SKILLS

Programming: R • Python • Bash • R Shiny • \LaTeX • git • SQL • HPC (SLURM)

Machine Learning: Tidymodels • Keras • Tensorflow

Data Mining: statistical analysis • dimensionality reduction • clustering • visualization

Modeling: dynamical systems • topological analysis • toy model development

Research: algorithm & pipeline development • inter-disciplinary collaboration • software development

Laboratory: CRISPR/Cas-9 genome editing • plasmid design • molecular cloning • qPCR

Languages: English • Hebrew

SOFTWARE (HIGHLIGHTS)

Fasano-Franceschini Test - R Package

An open-source implementation of the Fasano and Franceschini test – a 2-D Kolmogorov-Smirnov (KS) two-sample test – downloaded by 3100+ in the R community.

R Package Website: [\[Link\]](#)

TimeCycle - R Package

A non-parametric method that leverages results from dynamical systems theory and topology to test whether a dynamical variable (gene expression) exhibits cycling dynamics.

R Package Website: [\[Link\]](#) • **Video Tutorial:** [\[Link\]](#)

TimeTrial - R Shiny Web Application

An interactive software suite that enables circadian researchers to perform head-to-head comparisons of four leading cycle detection methods using both synthetic and biological data.

R Shiny Synthetic Data: [\[Link\]](#) • **R Shiny Biological Data:** [\[Link\]](#) • **Video Tutorial:** [\[Link\]](#)

Additional work can be found on my GitHub profile: [github.com/nesscoder](#)

PUBLICATIONS

- [1] **Ness-Cohn, Elan** and Rosemary Braun. TimeCycle: Topology Inspired MEthod for the Detection of Cycling Transcripts in Circadian Time-Series Data. *Bioinformatics*, jun 2021.
- [2] **Ness-Cohn, Elan**, Ravi Allada, and Rosemary Braun. Comment on “Circadian rhythms in the absence of the clock gene Bmal1”. *Science*, 372(6539), 2021.
- [3] **Ness-Cohn, Elan**, Marta Iwanaszko, William L Kath, Ravi Allada, and Rosemary Braun. TimeTrial: An interactive application for optimizing the design and analysis of transcriptomic times-series data in circadian biology research. *J Biol Rhythms*, 35:439–451, 2020.
- [4] Douglas J. Cattie, Claire E. Richardson, Kirthi C. Reddy, **Ness-Cohn, Elan**, Rita Droste, Mary K. Thompson, Wendy V. Gilbert, and Dennis H. Kim. Mutations in nonessential eIF3k and eIF3l genes confer lifespan extension and enhanced resistance to ER stress in caenorhabditis elegans. *PLoS Genetics*, 12(9):e1006326, 2016.

MANUSCRIPTS SUBMITTED / IN PREPARATION

- [1] **Ness-Cohn, Elan** and Rosemary Braun. Fasano-Franceschini Test: an Implementation of a 2-Dimensional Kolmogorov-Smirnov test in R. *arXiv*, page 2106.10539, sept 2021 (**in review at The R Journal**).
- [2] **Ness-Cohn, Elan**, Dae-sung Hwangbo, William L Kath, Ravi Allada, and Rosemary Braun. TimeChange: Topology Inspired MEthod for the detection of differential cycling dynamics in circadian transcriptomic time-series data. *In Preparation*, 2021.

TEACHING

Northwestern University – Searle Teaching Certificate Program

2020 – 2021

A year long sequence of seminars, special-topics workshops, and guidance provided by peer and faculty mentors focused on improving student learning and inclusion in their disciplines.

- Designed/developed an *Intro to Data Science Lab Course* complete with a course outline, sample lesson plan, sample assessments, grading scheme, evaluation plan, and interpretation of teaching effectiveness.

Northwestern University

What Do Your Data Say? (DataScience Bootcamp), Teaching Assistant

Spring 2020

IGP 486: Advanced Bioinformatics/Genomics, Teaching Assistant

Winter 2020

Collabrative Learning & Intergrated Mentoring in the BioSciences (CLIMB)

IGP 405: Cell Biology, Teaching Mentor

Winter 2021

IGP 484: Biostatitics, Teaching Mentor

Fall 2020

IGP 484: Biostatitics, Teaching Mentor

Fall 2019

Massachusetts Institute of Technology

7.012: Introductory Biology, Teaching Assistant

Spring 2017

18.05: Introduction To Probability and Statistics, Teaching Assistant

Spring 2016

Department of Biology Tutoring Program, Tutor

2016–2017

Introductory Biology, Introductory Experimental Biology and Communication,
Genetics, Biochemistry, Cell Biology

PRESENTATIONS

Topological Strategies for the Analysis of Rhythmic Dynamics in Transcriptomic Time-Series Data

Talk, International Conference on Intelligent Systems for Molecular Biology (ISMB), Virtual

2021

TimeCycle: Topology Inspired MMethod for the Detection of Cycling Transcripts In Circadian Time-Series Data

Microtalk, 3rd Annual Conference on Quantitative Approaches in Biology, Northwestern

2020

TimeCycle: Topology Inspired MMethod for the Detection of Cycling Transcripts In Circadian Time-Series Data (Canceled Covid-19)

Minisymposium, Conference on the Life Sciences (LS20), California

2020

TimeCycle: Topology Inspired MMethod for the Detection of Cycling Transcripts In Circadian Time-Series Data

Poster, 3rd Annual Southeaster Center for Mathematics & Biology Symposium, Georgia Tech

2020

TimeCycle: Topology Inspired MMethod for the Detection and Direct Comparison of Cycling Transcripts Across Conditions

Poster, 2nd Annual Conference on Quantitative Approaches in Biology, Northwestern

2019

TimeTrial: Interactive Application for the Design and Analysis of Transcriptomic Time-Series Data in Circadian Biology Research

Poster, Chicago Biomedical Informatics Data Jam, Chicago

2019

TimeCycle: Topology Inspired MMethod for the Detection and Direct Comparison of Cycling Transcripts Across Conditions

Poster, Chicago Biomedical Informatics Data Jam, Chicago

2019

TimeCycle: Topology Inspired MMethod for the Detection and Direct Comparison of Cycling Transcripts Across Conditions

Poster, 1st Annual Conference on Quantitative Approaches in Biology, Northwestern

2018

MENTORSHIP

May Nguyen, Undergraduate Research Assistant

Quantitative Biology Undergraduate Summer Research Program

Summer 2021

Coupling Environmental Inputs to Circadian Outputs in Drosophila

Kelly Paquin, Undergraduate Research Assistant

Quantitative Biology Undergraduate Summer Research Program

Summer 2020

Automating the Detection of Circadian Genes from Luciferase Reporter Construct in Drosophila

Carolina Clark, Ph.D. Candidate

DGP Student Assisted Mentoring Program (STAMP)

2020–2022

Samuel Hamilton, Ph.D. Candidate

DGP Student Assisted Mentoring Program (STAMP)

2019–2022

AWARDS

NSF-Simons Center for Quantitative Biology Travel Grant

Northwestern University

2021

Boit Prize for Engineering Writing

Massachusetts Institute of Technology

2017

Senior Thesis - *Regenerative Medicine and Synthetic Biology: Working Toward the Clinic*

SERVICE

Professional Memberships and Leadership Roles

Driskill Graduate Program In the Life Sciences, Student Council Rep

2020–2022

NSF-Simons Center for Quantitative Biology Leadership Team, Graduate Student Rep

2019–2022