

# Elan Ness-Cohn

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## EDUCATION

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### Ph.D. (Biology)

Northwestern University, Evanston

08/2017–12/2021 (Anticipated)

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

2020–2021

### 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

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### Braun Lab

**Ph.D. Candidate**, Northwestern University

08/2017–date

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

- ★ Created a user-friendly, web-based platform for circadian researchers to optimize the design and analysis of \*omic time-series experiments.
- ★ Developed a novel reference-free, non-parametric method using principles from dynamical system theory and topological analysis to identify cycling genes in circadian transcriptomic time-series data.
- ★ Formulated a novel reference-free, non-parametric method using principles from dynamical system theory and inferential statistics to identify differentially cycling genes across experimental conditions in circadian transcriptomic time-series data.

### Jaenisch Lab

**Undergraduate Research Assistant**, Massachusetts Institute of Technology

2016–2017

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

- ★ Utilized previously acquired laboratory techniques to design/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

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**Programming:** R • Python • Bash • R Shiny •  $\text{\LaTeX}$  • git • SQL • HPC (SLURM)

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

**Modeling:** dynamical systems • topological analysis • toy model development

**Machine Learning:** practical experience with classification & regression methods

**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)

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### 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/nesscoder](https://github.com/nesscoder)

## PUBLICATIONS

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- [1] **Ness-Cohn, Elan**, Ravi Allada, and Rosemary Braun. Comment on “Circadian rhythms in the absence of the clock gene *Bmal1*”. *Science*, 372(6539), 2021.
- [2] **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.
- [3] 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

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- [1] **Ness-Cohn, Elan** and Rosemary Braun. TimeCycle: Topology Inspired M<sup>E</sup>thod for the detection of cycling transcripts in circadian time-series data. *bioRxiv*, page 2020.11.19.389981, 2020 (**in Review at Bioinformatics**).
- [2] **Ness-Cohn, Elan** and Rosemary Braun. TimeChange: Topology Inspired M<sup>E</sup>thod for the detection of differential cycling dynamics in circadian transcriptomic time-series data. *In Preparation*, 2021.
- [3] **Ness-Cohn, Elan** and Rosemary Braun. Fasano–Franceschini test: an implementation of a 2-dimensional Kolmogorov–Smirnov in R. *In Preparation*, 2021.

## PRESENTATIONS

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- 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 Southeastern 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

## TEACHING

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### 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: Biostatistics, Teaching Mentor Fall 2020
- IGP 484: Biostatistics, 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

## MENTORSHIP

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### **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–date

### **Samuel Hamilton, Ph.D. Candidate**

DGP Student Assisted Mentoring Program (STAMP)

2019–date

## AWARDS

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### **NSF-Simons Center for Quantitative Biology Training Grant**

Northwestern University

2018

### **Boit Prize for Engineering Writing**

Massachusetts Institute of Technology

2017

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

## SERVICE

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### **Professional Memberships and Leadership Roles**

Driskill Graduate Program In the Life Sciences, Student Council Rep

2020–date

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

2019–date