

## Trenton Blitz Bricken

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Blog: <https://trentonbricken.com>

### Education

Harvard University - Boston, Massachusetts, 2020 - Present (Doctoral Degree)

- 2<sup>nd</sup> year PhD student in the Systems, Synthetic and Quantitative Biology program in the Kreiman lab
- PhD thesis is on the extent to which Deep Learning and the brain are convergent. I am using Sparse Distributed Memory, a biologically plausible associative memory model, to investigate these connections.

Duke University - Durham, North Carolina, 2016 - 2020 (Undergraduate Degree)

- Duke and UNC Robertson Scholar. Merit scholarship with a focus on leadership. Included full funding of all university expenses for four years, including summer experiences
- Major in “Minds and Machines: Biological and Artificial Intelligence”, a self-made ‘Program II’ major covering Computer Science, Neuroscience, Statistics and Biology
- Cumulative GPA overall: 3.775, GPA in major: 3.781, took 7 grad. classes, featured four times on the Dean’s List

Eton College - Windsor, England, 2011 - 2016 (Secondary school)

- A2 subjects and results: A\* Economics, A Politics, A Maths, 5 Computer Science AP (self-taught)

### Publications (reverse chronological order)

*Attention Approximates Sparse Distributed Memory*

**Trenton Bricken\***, Cengiz Pehlevan

\*(First author)

*NeurIPS*, December 2021

Paper - <https://openreview.net/forum?id=WVYzd7GvaOM&notelId=l-hU8Fav3x#all>

Talk at MIT Center for Brains Minds+ Machines: <https://cbmm.mit.edu/video/attention-approximates-sparse-distributed-memory>

Blog post - <https://www.trentonbricken.com/Attention-Approximates-Sparse-Distributed-Memory/>

Code - <https://github.com/TrentBrick/attention-approximates-sdm>

Tweet-thread - <https://twitter.com/TrentonBricken/status/1458465726503784449?s=20>

*High-content screening of coronavirus genes for innate immune suppression reveals enhanced potency of SARS-CoV-2 proteins*

Erika J Olson\*, David M Brown\*, Timothy Z Chang, Lin Ding, Tai L Ng, H. Sloane Weiss, Peter Koch, Yukiye Koide, Nathan Rollins, Pia Mach, Tobias Meisinger, **Trenton Bricken**, Joshus Rollins, Yun Zhang, Colin Molloy, Yun Zhang, Bridget N Queenan, Timothy Mitchison, Debora Marks, Jeffrey C Way, John I Glass, Pamela A Silver<br>

\*(First authors)

*bioRxiv*, March 2021

Preprint - <https://www.biorxiv.org/content/10.1101/2021.03.02.433434v1>

Tweet-thread - <https://twitter.com/TrentonBricken/status/1367141915666317312?s=20>

*Computationally Optimized SARS-CoV-2 MHC Class I and II Vaccine Formulations Predicted to Target Human Haplotype Distributions*

Ge Liu\*, Brandon Carter\*, **Trenton Bricken**, Siddhartha Jain, Mathias Viard, Mary Carrington, David K Gifford<br>

\*(First authors)

*Cell Systems*, July 2020

Paper - <https://www.cell.com/cell-systems/fulltext/S2405-4712%2820%2930238-6#%20>

Code - <https://github.com/gifford-lab/optivax>

Preprint - <https://www.biorxiv.org/content/10.1101/2020.05.16.088989v1>

Tweet-thread - <https://twitter.com/TrentonBricken/status/1262407888842170370?s=20>

### Research and Work Experience

Gabriel Kreiman Lab - PhD Student, Boston Children’s Hospital/Harvard Medical School, Biophysics, July 2021 – Present

- Researching Associative Memory models, Vector Symbolic Architectures and their relations to Deep Learning models
- Mentoring/supervising two Harvard undergraduates on related research projects

David Gifford Lab - Visiting Researcher, MIT CSAIL, Computational Biology, April 2020 – August 2020

- Second author on COVID vaccine design (see Publications), preliminary discussions with Moderna.

Debora Marks Lab - Undergraduate Researcher, Harvard Medical School, Systems Biology, May 2019 - April 2020

- SARS-CoV-2 mutation effects and 3D structure prediction from sequence covariation, Summer 2020
  - Website: <https://marks.hms.harvard.edu/sars-cov-2>

- IARPA FunGCAT Project - identifying novel viral genes that suppress host immune response (see Publications)
- DARPA Biostasis Project - re-engineering cryptobiotic proteins from extremophiles to function in humans
- Michael Lynch Lab - Research Assistant, Duke University, BME Department, June 2018 - May 2019
- Making genetic engineering more safe, precise, and efficient by developing machine learning models to predict CRISPR cutting and homology directed repair rates for more optimal guide RNA design
- Sunflower County Freedom Project - Teaching Intern, Sunflower County Mississippi, May 2017 - July 2017
- Taught math to 9<sup>th</sup> and 7<sup>th</sup> grade students in a summer remedial education program
  - Designed and ran extra-curricular program titled: "From Kendrick to Le-Bron - The Secrets of Success"

## **Interests and Activities**

### Harvard University:

- Member of Theoretical Neuroscience Group - Boston graduate students meet, share research, and brainstorm
- Member of Boston Effective Altruism Community

### Duke University:

- Developed "Tail-Free Sampling" - a new method to generate sequences from autoregressive neural networks, July 2019 - December 2019
  - Work currently published as a blog post (<https://trentbrick.github.io/Tail-Free-Sampling/>)
- Investigated the ability for deep reinforcement learning agents to discover and prove Byzantine Fault Tolerant consensus protocols. Supervised by Dr. Kartik Nayak, September 2019 – September 2020
- Winning team at the American Statistical Association's (ASA) "Datafest @ Duke", April 2018 & 2019
  - ~400 competitors each year. In 2019 won "Best Insight" using Canadian National Women's Rugby Sevens data. In 2018 won "Judges Pick" using Indeed.com data
- Co-founder and Discussion Leader for the "Arete Fellowship", September 2018 - May 2018
  - A 10-week crash course in Effective Altruism for undergraduates. Had 70 applicants, accepted and taught 18 of them. End of course anonymous survey had the course rated as a 4.53 out of 5

### Eton College:

- Co-House Captain of Boarding House: Appointed by Housemaster as Co-Head of House of 55 boys, 2015 - 2016
- Founder and Chairman of The Eton and Holyport College Investment Club, 2014 - 2016
  - 24-member Investment Club of Sixth Form students (high school juniors and seniors) who independently raised from donors and managed a real money philanthropic fund of over £20,000

## **Skills, Qualifications and Personal Interests**

Computer programming including: Java, Python, Matlab, JavaScript & R; US, Canadian, and UK citizenship; Hobbies include squash, travel, and film photography (website: <https://blitz-analog.github.io/>)