

+1-(857) 600-9490

Cambridge, MA

David\_Bellamy@g.harvard.edu

# David Rémy Bellamy

PhD Candidate in Medical Machine Learning

Personal website

LinkedIn: drbellamy

Twitter: DavidRBellamy

I am a biochemist-turned-epidemiologist-turned-machine learning scientist. I am also a PhD candidate in my final year of Epidemiology and Biostatistics at the Harvard School of Public Health. In my PhD, I have developed deep learning methods for risk prediction in the intensive care unit as well as for causal inference in the presence of unmeasured confounding. In the past, I spent 6 years conducting research in molecular biology across several topics. You can read more about me on my personal website!

## SKILLS

Communication	English, French
Natural Sciences	Molecular biology, (epi)genetics
Quantitative Sciences	Deep learning, causal inference, statistics
Tools and Languages	Python (TF/Keras, PyTorch, Pandas, Numpy, etc.), R (tidyverse), Cloud (Azure) Git, Makefile, Slurm, Bash/Linux, $\LaTeX$ , Markdown, SQL, unit testing, OOP

## EDUCATION

Doctor of Philosophy in Epidemiology, Harvard University	Sep 2018 — Present
Masters of Science in Biostatistics, Harvard University	Sep 2018 — Present
Doctor of Philosophy in Biomedical Science, Harvard University	Sep 2016 — Jan 2018 (left)
Honours Bachelor of Science in Biochemistry, University of Ottawa, <i>summa cum laude</i>	Sep 2011 — May 2016

## PUBLICATIONS

### Published Articles

**Deep Learning Methods for Proximal Inference via Maximum Moment Restriction** 2022  
*NeurIPS 2022 Main Conference*, [Preprint here: arXiv](#)

- Ben Kompa\*, [David Bellamy\\*](#), Tom Kolokotronis, James Robins, Andrew L. Beam.
- \* Denotes equal contribution.

**A structural characterization of shortcut features for prediction** 2022  
*European Journal of Epidemiology*, [Paper here](#)

- [David Bellamy](#), Miguel Hernan, Andrew L. Beam.

**Evaluating Progress on Machine Learning for Longitudinal Electronic Healthcare Data** 2020  
[Preprint here: arXiv](#)

- [David Bellamy](#), Leo Celi, Andrew L. Beam.
- Under preparation for submission to a conference.

**Charity Care: Do Nonprofit Hospitals Give More than For-Profit Hospitals?** 2020  
*Journal of General Internal Medicine*, [Paper here](#)

- Joseph D. Bruch, [David Bellamy](#).

**Reciprocal cellular cross-talk within the tumor microenvironment promotes oncolytic virus activity** 2015  
*Nature Medicine*, [Paper here](#)

- Carolina S Ilkow, Monique Marguerie, Cory Batenchuk, Justin Mayer, Daniela Ben Neriah, Sophie Cousineau, Theresa Falls, Victoria A Jennings, Meaghan Boileau, [David Bellamy](#), et al.

### Manuscripts under Preparation

**Extending Transformers to massive laboratory datasets in electronic health records** 2022

- [David Bellamy](#), Bhawesh Kumar, Cindy Wang, Andrew L. Beam.
- My first dissertation paper, coming soon.

**Minimax optimization of the proximal inference bridge function** 2023

- [David Bellamy\\*](#), Tom Kolokotronis\*, James Robins, Andrew L. Beam.

**Theoretical equivalence between the Transport algorithm and a simple set of graphical criteria** 2023

- [David Bellamy](#), James Robins.

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## PolyMed: a massively multimodal Transformer for electronic health records

2023

- David Bellamy\*, Anil Panepu\*, Andrew L. Beam.

## HONORS & AWARDS

### 2nd place in the Harvard LISH datathon

Feb 2022

- Placed second out of 60 teams from top US institutions doing a binary prediction task. Our solution used an ensemble of random forest and XGBoost models.

### \$1500 McMahon Fund

Jan 2022

- Awarded to attend a technical causal inference workshop at The Simons Institute, Theory of Computing.

### \$60,000 UCB Pharma Fellowship

2021 — Present

- Selected as the recipient by the Department of Epidemiology, to support the remainder of my PhD.

### First place \$1000 prize at Connecting Young Minds

2015

- Won first place at the University of Ottawa's research presentation competition by popular vote.

### Canada's \$8000 NSERC-USRA

2013 & 2015

- The Canadian Natural Sciences and Engineering Council offers undergraduate student research awards to top applicants.
- I conducted two summers of research with this funding.

### OHRI's Best Summer Student Researcher

2014

- The Ottawa Hospital Research Institute awarded \$500 to the most promising student.

### J. Armand Bombardier \$4000 Scholarship for Research Abroad

2014

- I moved to Boston in the fall of 2014 to conduct epigenetics research at Harvard Medical School.

### First place at Healthcare Symposium

2014

- The University of Ottawa held a research presentation competition for healthcare.

### Merit scholarship for exceptional standing

2012 — 2016

- The University of Ottawa awarded this to undergraduates in the top percentile of the grade distribution.

## RESEARCH EXPERIENCE

### PhD Candidate with Drs. Andrew Beam and Miguel Hernan

July 2020 — Present

Harvard School of Public Health

Cambridge, MA

- Completing my dissertation research in the Harvard CAUSALab.
- Developing novel deep learning architectures better-suited for medical data.
- Currently extending the Transformer model to handle continuous data.
- Also developing applications of deep learning algorithms in causal inference with Dr. James Robins.

### PhD student with Dr. Elise Robinson

Sep 2018 — July 2020

Stanley Center for Psychiatric Research at Broad Institute

Boston, MA

- Began my PhD here, working on a massive factor analysis of the UK BioBank's questionnaire data.
- Modelled factor scores for each patient as a function of genetic markers.
- This permitted the discovery of novel SNPs associated with latent constructs like depression and anxiety.

### PhD student with Dr. Eric Greer / Heritable epigenetics

Sep 2016 — Dec 2016

Harvard Medical School

Boston, MA

- Studied regulators of DNA methylation and how they influence transgenerational gene expression.
- Developed a screening assay using biochemical fractionation and an HPLC-MS methylation assay to discover new regulators.
- Performed a knock-out screen in *C. elegans* to assess transgenerational phenotypes.

### Researcher with Dr. Kathryn Wright / Virology

Sep 2015 — May 2016

University of Ottawa

Ottawa, Canada

- Studied curcumin's inhibition of the HPIV3 virus's replication.

### Researcher with Dr. Daniel Figeys / Mass spectrometry

May 2015 — Aug 2015

Ottawa Institute of Systems Biology

Ottawa, Canada

- Developed a mass spec.-based technique for identifying novel low molecular weight peptides in the hypothalamus and hippocampus of *Mus musculus* for applications to human disease profiling.

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## Researcher with Dr. Yang Shi / Epigenetics

*Boston Children's Hospital*

Sep 2014 — Dec 2014

*Boston, MA*

- Studied the epigenetic factors in the myeloid differentiation block in acute myeloid leukemia.
- Conducted high-throughput RNAi and chemical inhibitor screens of chromatin-regulating enzymes.
- Followed up the screen with CRISPR knockouts of promising candidates.

## Researcher with Dr. John Bell / Viral cancer therapy

*Ottawa Hospital Research Institute*

Jan 2014 — Aug 2014

*Ottawa, Canada*

- Conducted a high-throughput RNAi screen of a virus library in search of enhancer miRNAs.
- Cloned candidate miRNAs into clinically approved oncolytic viruses (VSV & MG-1).
- Performed *in vitro* and *in vivo* testing of cloned viruses.

## Researcher with Dr. Darrin Richeson / Inorganic chemistry

*Chemistry department, University of Ottawa*

May 2013 — Sep 2013

*Ottawa, Canada*

- Designed the synthesis of a high molecular weight ligand, capable of binding Rhenium ions.
- The Rhenium-ligand complex was tested for its capacity to reduce  $CO_2$  to formic acid when stimulated by UV.

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## MENTORSHIP EXPERIENCE

### Cindy Wang / Harvard Undergraduate in CS & Pre-Med

June 2021 — Present

- Held weekly meetings from her freshman year onwards.
- We are currently collaborating on a deep learning project.

### Bhawesh Kumar / Harvard MSc student in Health Data Science

Sep 2021 — Present

- Held weekly meetings throughout his MSc.
- We are currently collaborating on a deep learning project.

### Michael Smith / Harvard MSc student in Epidemiology

Sep 2021 — Present

- Held monthly meetings throughout his MSc.
- I help formalize his research interests in causality and machine learning.

### Denys Shay / Harvard PhD student in Epidemiology

Sep 2021 — Present

- I am his assigned "epi buddy."
- I have helped him pick courses for the first 2 years of his PhD in Epidemiology.

### Zhaoxun Hou / Harvard MSc student in Epidemiology

Sep 2021 — Present

- I am his assigned "epi buddy."
- I have helped him pick courses and prepare applications to Biostatistics PhD programs.

### Sarthak Agarwal / Matriculating PhD student in Nutritional Epidemiology

Oct 2021 — Present

- I edited his application to the HSPH PhD program and he was accepted.

### Brandon Spiegel / Data Scientist at Qventus

Oct 2021 — Present

- A data scientist in the private sector who I have educated on causality, ML and graduate education.

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## TEACHING EXPERIENCE

### Deep Learning Teaching Fellow

March 2022 — May 2022

*Harvard EPI290 / BMI707*

- Worked as a teaching fellow with Drs. Andrew Beam and Kun-Hsing Yu in the main course on deep learning at the Harvard Medical campus.
- This course used Tensorflow/Keras.

### Epidemiology Department Tutor

Feb 2022 — May 2022

*Harvard School of Public Health*

- Tutored Masters students in Epidemiology for statistics, learning R, and the core epidemiologic methods courses (EPI201/202/289/203/204).

### Epidemiology & Biostatistics Teaching Fellow

June 2021 — Aug 2021

*Harvard ID207 & ID208*

- Assisted Drs. Brian Healy and Pamela Rist in the full-time summer foundations course for the Masters of Public Health in Epidemiology.
- Led programming tutorials for students to learn how to analyze data with STATA.

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## Biochemistry Teaching Fellow (French)

*University of Ottawa BCH2333*

Jan 2016 — April 2016

- Gave sections for the core second year class in Biochemistry in French (150 students).

## ACTIVITIES

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### Journal reviewer

- Nature Communications, Nature Scientific Data, uOttawa Journal of Medicine.

### Harvard student mental health representative

- Assisted Dr. Paul Barreira in tailoring a mental health survey to the Population Health Sciences PhD students.

### Biochemistry curriculum representative

- Provided perspectives on biochemistry learning objectives and course content.
- Participated in redesigning the undergraduate biochemistry curriculum at the University of Ottawa.
- Helped create a more research-focused biochemistry degree.