

# Stephen Woloszynek MD PhD

PGY4 ANESTHESIA RESIDENT, LORING SCHOLAR, HARVARD CLINICAL FELLOW IN ANESTHESIA

Beth Israel Deaconess Medical Center, Boston, MA 02215

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## Research Interests

Machine learning. Neural networks. Large language models. Bayesian statistics. Multilevel models. Natural language processing. Time series analysis. Anesthesia. Perioperative outcomes. Event detection. Decision support. Health informatics.

## Education

### Beth Israel Deaconess Medical Center

Boston, MA

RESIDENCY, ANESTHESIA

2021 - 2025

- Loring Scholars/Clinical Scientist Research Track
- Mentor: Maximilian S. Schaefer MD
- Lab: CARE - Perioperative Outcomes Lab

### Beth Israel Deaconess Medical Center

Boston, MA

INTERNSHIP

2020 - 2021

- Medicine/Surgery

### Drexel University

Philadelphia, PA

DOCTOR OF MEDICINE

2012 - 2020

- Physician Scientist Training Program

### Drexel University

Philadelphia, PA

DOCTOR OF PHILOSOPHY, ELECTRICAL & COMPUTER ENGINEERING

2014 - 2018

- Mentor: Gail L. Rosen PhD
- Lab: Ecological and Evolutionary Signal-Processing and Informatics Lab
- Thesis: Extracting Meaningful Features from Noisy Microbiome Data

### Drexel University

Philadelphia, PA

BACHELOR OF SCIENCE, BIOLOGY

2008 - 2010

- *Magna Cum Laude*

### Community College of Philadelphia

Philadelphia, PA

ASSOCIATE OF SCIENCE

2005 - 2012

- *Summa Cum Laude*

## Awards & Honors

2018	<b>Finalist, Research Excellence Awards</b> , Drexel University	Philadelphia, PA
2018	<b>Student Scholarship</b> , StanCon	Pacific Grove, CA
2016-18	<b>Frank and Agnes Seaman Endowed Fellowship (x3)</b> , Drexel University	Philadelphia, PA
2016	<b>Epstein Fellow</b> , Interurban Clinical Club	Philadelphia, PA
2016	<b>Lee Smith Traveling Fellowship</b> , Drexel University	Philadelphia, PA
2016	<b>Study Abroad Asia Fund Travel Grant</b> , Drexel University	Philadelphia, PA
2016	<b>Medical Student Research Conference Grant</b> , Drexel University	Philadelphia, PA
2016	<b>Leroy Resser Endowed Fellowship</b> , Drexel University	Philadelphia, PA
2011	<b>ASPN Presentation Award</b> , American Society of Pediatric Nephrology	Denver, CO
2008-10	<b>Dean's Scholarship</b> , Drexel University	Philadelphia, PA

## Academic Employment

2010-12	<b>Laboratory Manager</b> , Gail Hearn PhD, Drexel University	Philadelphia, PA
2009-11	<b>Research Assistant</b> , Kevin Meyers MD, Children's Hospital of Philadelphia	Philadelphia, PA

## Professional Affiliations

## Scientific Contributions

### Peer Reviewed Research

- Mitchell, D. V., **Woloszynek, S.**, Mitchel, M. W., Cronin, D., Zhao, Z., Rosen, G. L., O'Connor, M. P., Fero, M. and Gonder, M. K. Growth and globalization of the Central African wildlife economy: Insights from a 23-year study of wild meat markets on Bioko Island, Equatorial Guinea. 2024. *Submitted for review.*
- Zhao, Z., **Woloszynek, S.**, Agbavor, F., Mell, J. C., Sokhansanj, B. A., and Rosen, G. L. Learning, Visualizing and Exploring 16S rRNA Structure Using an Attention-Based Deep Neural Network. 2021. *PLoS Comp Bio* 17 (9), e1009345.
- Smith, S. H., O'Connor, M. P., Deal, B., Kotzer, C., Lee, A. Wagner, B., Joffe, J., **Woloszynek, S.**, Oliver, K. M., Russell, J. A. Does getting defensive get you anywhere?— Seasonal balancing selection in pea aphids shapes a dynamic infection polymorphism with a protective bacterial endosymbiont. 2021. *Molecular Ecology* 30 (10), 2449-2472
- Woloszynek, S.**, Mell, J. C., Zhao, Z., Simpson, G., O'Connor, M. P., and Rosen, G. Exploring thematic structure and predicted functionality of 16S rRNA amplicon data. 2019. *PLoS ONE* 14 (12).
- Woloszynek, S.**, Zhao, Z., Chen, J., and Rosen, G. 16S rRNA sequence embeddings: Meaningful numeric feature representations of nucleotide sequences that are convenient for downstream analyses. 2019. *PLoS Comp Bio* 15 (2).
- O'Hara, N. B., Reed, H. J., Afshinnekoo, E., Harvin, D., Caplan, N., Rosen, G., Frye, B., **Woloszynek, S.**, Ounit, R., Levy, S., Butler, E., and Mason, C. E. Metagenomic characterization of ambulances across the USA. 2017. *Microbiome* 5 (1).
- Cronin, D., **Woloszynek, S.**, Morra, W. A., Honarvar, S., Linder, J. M., Gonder, M. K., O'Conner, M. P., and Hearn, G. W. Long-term urban market dynamics reveal increased bushmeat carcass volume despite economic growth and proactive environmental legislation on Bioko Island, Equatorial Guinea. 2015. *PLoS ONE* 10 (7).
- Kangovi, S., Edwards, M., **Woloszynek, S.**, Mitra, N., Feldman, H., Kaplan, B. S., and Meyers, K. E. Renin-angiotensin-aldosterone system inhibitors in pediatric focal segmental glomerulosclerosis. 2012. *Pediatric Nephrology*. 27 (5): 813–9.

### Chapters and Reviews

- Kompa, B., Hakim, J. B., Palepu, A., Kompa, K. G., Smith, M., Bain, P. A., **Woloszynek, S.**, Painter, J. L., Bate, A., Beam, A. L. Artificial Intelligence and Machine Learning in Pharmacovigilance: A Systematic Scoping Review. 2022. *Drug Saf.* 45(5):477-491.
- Cullen, C., Aneja, K. K., Beyhan, S., Cho, C. E., **Woloszynek, S.**, Mccoy, S. J., Zhang, Y., Anderson, M., Alvarez-Ponce, D., Smirnova, E., Karstens, L., Dorrenstein, P. C., Li, H., Gupta, A. S., Cheung, K., Powers, J. G., Zhao, Z., and Rosen, G. Emerging Priorities for Microbiome Research. 2020. *Frontiers in Microbiology*.
- Woloszynek, S.**, Zhao, Z., Ditzler, G., Price, J. R., Reichenberger, E. R., Lan, Y., Chen, J., Earl, J., Langroodi, S. K., Ehrlich, G., and Rosen, G. Analysis Methods for Shotgun Metagenomics. 2018. *Theoretical and Applied Aspects of Systems Biology*. Springer.
- Ching, T., Himmelstein, D. S., Beaulieu-Jones, B. K., Kalinin, A.A., Do, B. T., Way, G.P., Ferrero, E., Agapow, P.M., Zietz, M., Hoffman, M.M., Xie, W., Rosen, G. L., Lengerich, B.J., Israeli, J., Lanchantin, J., **Woloszynek, S.**, Carpenter, A. E., Shrikumar, A., Xu, J., Cofer, E. M., Lavender, C. A. Turaga, S. C., Alexandari, A. M., Lu, Z., Harris, D. J., DeCaprio, D., Qi, Y., Kundaje, A., Peng, Y., Wiley, L. K., Segler, M. H. S., Boca, S. M., Swamidass, S. J., Huang, A., Gitter, A., and Greene C. S. Opportunities and obstacles for deep learning in biology and medicine. 2018. *Journal of the Royal Society Interface*. 15 (141).
- Woloszynek, S.**, Pastor, S. J., Mell, J. C., Nandi, N., Sokhansanj, B., and Rosen, G. Engineering human microbiota: influencing cellular and community dynamics for therapeutic applications. 2016. *IRCMB*. 324: 67-124.

### Conference Papers and Abstracts

- Woloszynek, S.**, Munoz-Acuna, R., Ma., M., and Schaefer, M. S. Feature Engineering of Unstructured Hospital Notes for Downstream Classification of Delirium. 2023. *ASA*. San Francisco, CA.
- Hill, G., Lombardi, A., Gaffney, L., Hill, H., Gutekunst, J., Davis, H., **Woloszynek, S.**, and Stern, S. Patient-directed discharges are associated with poor health outcomes in opioid use disorder. 2023. *ASAM*.
- Venditti, D., **Woloszynek, S.**, Zhao, Z., Rosen, Morra, W., Ondo nze avomo, J., G. L., Cronin, D., O'Conner, M. P., Hearn, G. W., and Gonder. Understanding an unsustainable Central African bushmeat commodity chain: A multidisciplinary approach. 2020. *IPS*.
- Venditti, D., **Woloszynek, S.**, Zhao, Z., Rosen, Morra, W., Ondo nze avomo, J., G. L., Cronin, D., O'Conner, M. P., Hearn, G. W., and Gonder. Understanding an unsustainable Central African bushmeat commodity chain: A multidisciplinary approach. 2020. *STE*.
- Smith, A. H., O'Connor, M. P., **Woloszynek, S.**, Oliver, K. M., and Russell, J. A. Does getting defensive get you anywhere? - Dissecting the causes of rapid symbiont dynamics in the pea aphid. 2018. *Wolbachia* meetings.
- Price, J., Nan, Y., Wang, Y., Cheng, M., Keshani, S., **Woloszynek, S.**, Rosen, G., Yuan, L., and Sales, C. Predation and parasitism induces community stability and performance within EBPR reactors. 2019. *American chemical society* 257.
- Mitchell, M. W., **Woloszynek, S.**, Al-Ghalith, G., Clayton, J. B., Rosen, G. L., Gonder, M. K., and Knights, D. Habitat variation impacts chimpanzee gut microbiome diversity in Cameroon. 2018. *International Society of Primatologists*, Nairobi.
- Vanderkluisen, L., Barber, N., **Woloszynek, S.**, O'Connor, M. P., Mittal, T., Sealing, C., Sprain, C., and Renne, P. Statistical Analysis of Deccan Basalt Geochemistry: An Updated Look at Deccan Chemostratigraphy. 2017. *American Geophysical Union*.
- Vanderkluisen, L., Barber, N., **Woloszynek, S.**, O'Connor, M. P., Mittal, T., Sealing, C., Sprain, C., and Renne, P. A Modern Look at the Deccan Chemostratigraphic Scheme. 2017. *Geological Society of America*.
- Cronin, D. T., **Woloszynek, S.**, Long term monitoring of a bushmeat market in Bioko, Equatorial Guinea. 2014. *Annual Meeting of the Society*

## Working Papers

- **Woloszynek, S.**, Munoz-Acuna, R., Ma., M., and Schaefer, M. S. Delirium Detection with a Semi-Supervised Large Language Model Approach.
- von Wedel, D., Redaelli, S., Wachtendorf, L. J., Ahrens, E., Rudolph, M. I., Shay, D., Chiarella, L. S., Suleiman, A., Munoz-Acuna, R., Ashrafian, S., Seibold, E., **Woloszynek, S.**, Chen, G., Eikermann, M., Talmor, D., Banner-Goodspeed, V., Oriol, N. E., and Schaefer, M. S. The association of anaesthesia provider sex with perioperative complications in male and female patients: a multicentre retrospective cohort study.
- Mitchell, M. W., **Woloszynek, S.**, Al-Ghalith, Featherstone, B. S., G., Clayton, J. B., Rosen, G. L., Gonder, M. K., and Knights, D. Environmental drivers shape the chimpanzee gut microbiome in a biodiversity hotspot.

## Invited Talks

- **Woloszynek, S.**, Mell, J. C., Simpson, G., and Rosen, G. Identifying microbial subcommunities associated with host metadata via a topic modelling framework. 214th Meeting of the Interurban Clinical Club. November 4, 2016. University of Pennsylvania. Philadelphia, PA.
- **Woloszynek, S.**, Mell, J. C., Simpson, G., and Rosen, G. Identifying microbial subcommunities associated with host metadata via a topic modelling framework. International Symposium on Molecular Medicine and Infectious Disease. September 15, 2016. Drexel University College of Medicine. Philadelphia, PA.

## Poster Presentations

- **Woloszynek, S.**, Munoz-Acuna, R., Ma., M., and Schaefer, M. S. Feature Engineering of Unstructured Hospital Notes for Downstream Classification of Delirium. 2024. Anesthesia Research Retreat. Boston, MA.
- Meier, T. A., **Woloszynek, S.**, and Post, R. Analyzing health disparities and differential health outcomes in drug and opioid users. STFM. Virtual, 2021.
- **Woloszynek, S.**, Zhao, Z., O'Connor, M., Mell, J. C., Simpson, G., and Rosen, G. Themetagenomics: Uncovering thematic structure in 16S rRNA marker gene survey. (1) Discovery Day. Drexel University, Philadelphia, PA, 2018. (2) Emerging Graduate Scholars Conference. Drexel University, Philadelphia, PA, 2018. (3) DIG's 10th Annual Research Symposium, Drexel University, Philadelphia, PA, 2018, **2nd place**. (4) Microbiome, Host Resistance and Disease X4. Banff, Alberta, Canada, 2018.
- **Woloszynek, S.**, Mell, J. C., Simpson, G., and Rosen, G. Identifying Microbial Subcommunities Associated with Host Metadata via a Topic Modelling Framework. (1) Penn PROMOTES Retreat, University of Pennsylvania, Philadelphia, PA, 2017. (2) DIG's 9th Annual Research Symposium, Drexel University, Philadelphia, PA, 2017, (3) IHMC 2016. Houston, TX, 2016. (4) 3rd Annual Microbiome Symposium. Children's Hospital of Philadelphia. Philadelphia, PA, 2016. (5) 2016 Mid Atlantic Bioinformatics Conference. Children's Hospital of Philadelphia. Philadelphia, PA, 2016. (6) Discovery Day 2016, Drexel University College of Medicine, Philadelphia, PA, 2016.
- **Woloszynek, S.**, Mell, J. C., and Rosen, G. Uncovering Metagenomic Topics Associated with Host Metadata. (1) Bridging Biomedical Worlds 2016. Hong Kong, China, 2016.
- **Woloszynek, S.**, Tabb, L. P., and Rosen, G. Accounting for Zero-Inflation and Taxon-Correlations in Human Microbiome Data. DIG's 8th Annual Research Symposium, Drexel University, Philadelphia, PA, 2016.
- **Woloszynek, S.**, Tabb, L. P., and Rosen, G. A Zero-Inflated MVPLN Model for Correlated OTU Abundances. Discovery Day 2015, Drexel University College of Medicine, Philadelphia, PA, 2015.
- **Woloszynek, S.**, Tabb, L. P., and Rosen, G. Overcoming Zero Inflation in Sparse OTU Tables. DTRA/NSF Workshop: Algorithms for Threat Detection, NSF, Arlington, VA, 2015.
- **Woloszynek, S.**, Rosen, G. Prediction of Host Traits through Microbiota Composition via Supervised LDA. Research Day 2015, Drexel University, Philadelphia, PA, 2015.
- **Woloszynek, S.**, Sperling, M., Sharan, A., and Jacobs, J. Electrographic Recordings Reveal Distinct Neural Patterns for Working Memory Performance. (1) NE Regional APSA Meeting, Temple University, Philadelphia, PA, 2013. (2) Discovery Day 2013, Drexel University College of Medicine, Philadelphia, PA, 2013.
- Cronin, D.T., **Woloszynek, S.**, Morra, W.A., Honarvar, S., Linder, J.M., O'Connor, M.P., Hearn, G.W. Emergent trends in an urban bushmeat market on Bioko Island, Equatorial Guinea. XXIV. Congress of the International Primatological Society, Cancun, Mexico, 2012.
- Cronin, D.T., **Woloszynek, S.**, O'Connor, M.P., Hearn, G.W. Bushmeat Hunting on Bioko Island, Equatorial Guinea Suggests a Network of Organized Crime. 14th Annual Research Day, Drexel University, Philadelphia, PA, 2012.
- Cronin, D.T., **Woloszynek, S.**, O'Connor, M.P., Hearn, G.W. Bushmeat Hunting on Bioko Island, Equatorial Guinea Suggests a Network of Organized Crime. 6th College of Arts and Sciences. Research Day, Drexel University, Philadelphia, PA, 2012.
- Kangovi, S., Edwards, M., **Woloszynek, S.**, Feldman, H., Kaplan, B. S., and Meyers, K. RAAS Inhibitor Monotherapy in Pediatric FSGS Patients. Pediatric Academic Societies' and Asian Society for Pediatric Research Joint Meeting, Denver, CO, 2011.
- Cronin, D. T., **Woloszynek, S.**, Morra, W., Biacho, R. A., and Hearn, G. Changing composition of the Malabo bushmeat market, Bioko Island, Equatorial Guinea, XXIII Congress of the International Primatological Society, Kyoto, Japan, 2010.

## Software and Packages

- Themetagenomics. **Woloszynek, S.**, R package version 1.0.2., [github.com/sw1/themetagenomics](https://github.com/sw1/themetagenomics)
- Theseus. Price, J. R. and **Woloszynek, S.**, R package version 0.1.0., [github.com/sw1/theseus](https://github.com/sw1/theseus)
- Biomod2EZ. Sesnek Clee, P. R., **Woloszynek, S.**, and Gonder, M. K. 2017., [doi.org/10.1101/140855](https://doi.org/10.1101/140855), [github.com/psesinklee/biomod2ez](https://github.com/psesinklee/biomod2ez)

## Media Coverage

- “Laws Prohibiting Bush Meat Are Actually A Boon For The Bush Meat Biz.” NPR. August 2015.
- “Hunting Of Primates Increases With Economic Growth.” IFLScience. August 2015.

## Peer Reviewer

- mSystems, Editor: Gail L. Rosen PhD
- Frontiers in Microbiology, Editor: Michele Guindani PhD
- PeerJ, Editor: Ka-Chun Wong PhD

## Didactic

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### TEACHING

#### Eureka! STEM Girls Camp

GAIL L. ROSEN PHD

- Lecturer: using data to understand biology

Drexel University

2017

#### Multi-Disciplinary Digital Signal Processing

GAIL L. ROSEN PHD

- Lecturer: dynamic programming, alignment

Drexel University

2017

#### Statistical Analysis of Metagenomes

GAIL L. ROSEN PHD

- Lecturer: R, OTU picking, dada2, multiple comparisons, hypothesis testing, QIIME, parallel computing, bash

Drexel University

2016

#### Advances in DSP: Biological Signal Processing

GAIL L. ROSEN PHD

- Lecturer: neural networks, topic models, variational inference

Drexel University

2016

#### Bioinformatics

GAIL L. ROSEN PHD, JAKE RUSSELL PHD

- Lecturer: R, alignment, dynamic programming
- Teaching assistant

Drexel University

2016

#### Applied Bayesian Analysis

LONI TABB PHD

- Teaching assistant

Drexel University

2016

#### Introduction to Statistical Computing

LONI TABB PHD

- Teaching assistant

Drexel University

2016

### INDEPENDENT STUDY SUPERVISION

#### Felix Agbavor

UNDERGRADUATE, BIOMEDICAL ENGINEERING

- Projects: microbiome functional prediction

Drexel University

2017

#### Dhantha Gunarantha

UNDERGRADUATE, ELECTRICAL ENGINEERING

- Projects: microbiome functional prediction

Drexel University

2017

### TUTORING

#### Philadelphia Futures

HELENA MILLER

- Topics: algebra, trigonometry, English

Philadelphia, PA

2012 - 2013

## Groups & Clubs

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2015-17 **APSA, Drexel local chapter**, officer, institutional representative, webmaster

Philadelphia, PA

2015-16 **Hot Topics in Medicine**, platform designer/controller, contributor

Philadelphia, PA

## Conferences Attended

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2018	<b>StanCon</b>	<i>Pacific Grove, CA</i>
2017	<b>4th Annual Microbiome Symposium</b>	<i>Philadelphia, PA</i>
2016	<b>CCP's Ask Me How I Became Successful</b> , speaker	<i>Philadelphia, PA</i>
2016	<b>StanCon</b>	<i>New York, NY</i>
2015	<b>ASA Traveling Course: Bayesian Methods and Computing</b>	<i>Philadelphia, PA</i>

## Certifications

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2021-	<b>Neonatal Resuscitation (NRP)</b> , American Heart Association
2020-	<b>Advanced Cardiac Life Support (ACLS)</b> , American Heart Association
2018-	<b>Basic Life Support (BLS)</b> , American Heart Association

## Skills

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**Programming**   R, Python, C, Stan, Pytorch, TensorFlow, Matlab, Bash, SQL, regex, Git, cluster computing, HTML5,  $\LaTeX$