

Derek Hart, PhD

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EXPERIENCE

Centers for Disease Control and Prevention (Contracted by ASRT Inc.)

Atlanta, Georgia

Bioinformatician, Data Manager

Dec 2022 - Present

- Built and deployed production-level NGS data analysis workflows for nationwide surveillance of measles and mumps. Extensive use of Snakemake, Nextflow, Python, Linux, and HPC systems.
- Created cloud-based ETL pipeline and SQL database with Azure Data Lake and Databricks to rapidly assess proficiency of >100 molecular laboratories worldwide. Features real-time data ingestion and processing.
- Developed R Shiny dashboard to aggregate and visualize a global measles sequence database. Created interactive timeline charts, geographic map plots, and phylogenetic trees using popular Javascript libraries (e.g. D3, Highcharts).
- Collaborated with microbiologists to optimize tiling amplicon enrichment assay, enabling high coverage depth even for high-Ct samples in non-coding regions.

Georgia Institute of Technology

Atlanta, Georgia

Graduate Research Assistant

Jan 2017 - Nov 2022

- Designed and implemented single-molecule FRET microscopy assay to observe kinetics of short DNA duplexes subject to weak tensile force. Highly experienced with image and signal processing methods.
- Performed molecular dynamics simulations on high-performance cluster (HPC). Used advanced statistical sampling methods to observe energy landscape of rare transition states. Extensive use of Python data science libraries.
- 5 years of wet lab experience performing DNA/RNA-based protocols.

Graduate Teaching Assistant

Aug 2016 - Aug 2019

- Mentored electromagnetism and biophysics students during laboratory sections and office hours.

EDUCATION

Georgia Institute of Technology

Atlanta, Georgia

PhD Physics 3.7 GPA

Aug 2016 - Sep 2022

- **Area of Concentration:** Single-molecule biophysics
- **Thesis:** Hybridization and dehybridization of short oligonucleotides subject to weak tension
- **Minor:** Advanced Optics
- **Award:** Georgia Tech Institute Fellowship

Georgia Institute of Technology

Atlanta, Georgia

MS Physics

Aug 2016 - May 2018

Colorado School of Mines

Golden, Colorado

BS Engineering Physics 3.9 GPA

Aug 2013 - May 2016

- **Award:** Physics Faculty Distinguished Graduate

PUBLICATIONS

- B. Bankamp, G. Kim, D. Hart, A. Beck, Y. Zhang, M. Mamou, A. Penedos, R. Evans, P. Rota. "Global update on measles molecular epidemiology". *Vaccines*. 12.7. (Jul. 2024)
- A. Beck, E. Lopareva, H. Hwang, D. Hart, M. de Almeida, P. Rota, B. Bankamp. "Rapid Communication: Evaluation of the sensitivity of a measles diagnostic real-time RT-PCR assay incorporating recently observed priming mismatch variants, 2024". *Eurosurveillance*. 29.28. (Jul. 2024)
- M. Jumabaeva, E. Lopareva, M. Chen, D. Park, D. Hart, B. Bankamp, A. Beck. "Validation of High-Throughput Metagenomic Sequencing of Measles, Mumps and Rubella Viruses Using Simultaneous Complex Probe Enrichment". (in preparation)
- E. Tiller, A. Mathis, A. Beck, D. Hart, C. Dixey, D. Sugerman. "Measles outbreak among undervaccinated children during an unseasonal increase of respiratory virus activity in pediatric populations Columbus, OH, 2022". (in preparation)
- D. Hart, J. Jeong, J. Gumbart, H. Kim. "Weak tension accelerates hybridization and dehybridization of short oligonucleotides". *Nucleic Acids Res*. 51.7. (Apr. 2023), pp 3030-3040

ORAL PRESENTATIONS

- 2024: "Using workflow managers to improve sequencing reproducibility and quality control". Atlanta Winter Summit. Atlanta, GA.
- 2023: "Design of NGS Bioinformatics Pipeline to Improve Reproducibility and Quality Control". 21st Global Measles and Laboratory Network Meeting. Virtual conference.
- 2022: "Weak tension accelerates hybridization and dehybridization of short oligonucleotides". Annual Meeting of the International Physics of Living Systems Network. Montpellier, France.
- 2021: "Nucleic acid melting under small tension". Annual Meeting of the American Physical Society. Virtual conference.
- 2021: "Kinetics of DNA melting and hybridization under small tension". Physics of Living System Seminar. Atlanta, Georgia.
- 2019: "How do DNA bending and twisting affect CRISPR-Cas12 binding and cleavage?" Physics of Living Systems Seminar. Atlanta, Georgia.
- 2018: "Tracking Polymer Tangles". Physics of Living Systems Seminar. Atlanta, Georgia.

TECHNICAL SKILLS

- **Programming:** Python, Bash, R, MATLAB, LaTeX, Groovy, Javascript, C++, SQL
- **Bioinformatics:** Snakemake, Nextflow, Seqera Platform, HPC, Linux, Git, BLAST, Geneious Prime, CLC Genomics Server, Docker, Singularity, MultiQC, Highcharts, D3
- **DNA Biology:** Primer design, PCR, assay design, ligation, purification, quantification, gel electrophoresis, fluorophore modification, plasmid cloning, restriction digests
- **Modeling & Simulation:** Molecular Dynamics, Monte Carlo, forward-flux sampling, umbrella sampling, oxDNA, Hidden Markov Modeling
- **Data Science:** Pandas, Tidyverse, Scikit-learn, Matplotlib, Seaborn
- **Single-molecule Biophysics:** TIRF microscopy, FRET microscopy, surface passivation, rate kinetics, force spectroscopy
- **Interests:** Bouldering, Cooking, Japanese, D&D, Reading, Piano