

**Geisel School of Medicine at Dartmouth
Dartmouth-Hitchcock Medical Center
CURRICULUM VITAE**

NAME: Joshua Levy PhD

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I. EDUCATION:

2017 BS in Physics
University of California, Berkeley, CA
College of Letters & Sciences: Highest Distinction graduation (top 1%)

2021 PhD in Quantitative Biomedical Sciences (Data Science)
Dartmouth College, Geisel School of Medicine, Hanover, NH
Co-mentors: Brock C. Christensen PhD (Department of Epidemiology)
 Louis J. Vaickus MD, PhD (Department of Pathology and Laboratory Medicine)

Technical and Research skills:

Python • R • Shell • Supercomputer • Machine Learning • Dataviz • PyTorch • NLP
Sklearn • Plotly • Aircraft Pilot • Dask • Matlab • Javascript • C++ • SQL
Deep Learning • Docker • AWS • LaTeX • Nextflow • CWL Pipelines • Stan
Comp. Vision • Sensibly Constructing Statistical Golems • Graph Neural Networks

Relevant coursework:

Hierarchical, Bayesian Modeling, Social Network Analysis, Epidemiology, Biostatistics,
Bioinformatics, Linear Algebra, Diff. Eq., Multivar. Calc., C++, Python, Statistics,
Machine Learning, Health Promotion, Policy, Management, Quantum Computing and
Stat Mechanics

II. POSTDOCTORAL TRAINING: N/A

III. ACADEMIC APPOINTMENTS:

2021-present Assistant Professor, Geisel School of Medicine at Dartmouth,
Departments of Pathology and Laboratory Medicine, and Dermatology

2021-present Adjunct Professor, Geisel School of Medicine at Dartmouth,
Department of Epidemiology

2021-present Faculty, Geisel School of Medicine at Dartmouth,
Quantitative Biomedical Sciences

IV. INSTITUTIONAL LEADERSHIP ROLES:

2018-present EDIT (Emerging Diagnostic and Investigative Technologies) Research Program

Editor, Department of Pathology and Laboratory Medicine, DHMC.
Co-director of EDIT Machine Learning and Whole Genome Sequencing arms.

V. LICENSURE AND CERTIFICATION: N/A

VI. HOSPITAL OR HEALTH SYSTEM APPOINTMENTS: N/A

VII. OTHER PROFESSIONAL POSITIONS (NON-DARTMOUTH):

April 2015- Jun 2016	CiBER lab, Berkeley, CA • Agama Lizard Turns: Matlab and ProAnalyst analysis of lizard turning tendencies	Biomechanics Research Assistant
Jun 2016- May 2020	Lawrence Berkeley National Lab, JGI Affiliate, Berkeley, CA • Novel computational methods elucidate quality biofuels: pangenome phylogenetics, genomics workflows, metagenomics binning, machine learning via large-scale, automated, supercomputer pipelines (Python/Nextflow)	Software Developer
Jun - Dec 2017	San Francisco Department of Public Health: Tuberculosis Control, San Francisco, CA • Evaluated patient data integrity and transition to electronic health records.	Public Service Aide
May-Aug 2018	Zymergen, Emeryville, CA • Constructed many different HPC AWS bioinformatics pipelines using CWL Docker, and Seven Bridges, storing results in SQL databases. • Used Convolutional Neural Networks and hyperbolic embeddings to explore relationships between gene and function for discovery of biomaterials.	Software Engineer Intern
Jan 2020- present	ArcticAI, Hanover, NH • Developing core technology, IP, and vision for intraoperative medical device	Chief Technical Officer
Oct 2020- present	Veterans Affairs Healthcare System, White River Junction, VT • Consulting on machine learning-based natural language processing software for suicide risk prediction	Statistical Consultant

VIII. PROFESSIONAL DEVELOPMENT ACTIVITIES:

2018-present	CITI Program, Biomedical Responsible Conduct of Research (RCR) course completion
2018-present	CITI Program, Biomedical Data or Specimens Research Basic course, completion
2018-present	CITI Program, Good Clinical Practice (US, FDA focus) clinical trials with investigational drugs and medical devices (GCP) course completion
2019	Supervised Teaching Workshop, Mentor Skills Development
2019	NIH Grant Workshop
2017	Coaching Corps Leadership Development Program
2016	Crisis Support Counselor Training Program

IX. TEACHING ACTIVITIES:

A. UNDERGRADUATE (COLLEGE) EDUCATION: N/A

B. GRADUATE EDUCATION:

Courses:

Professional Level / Online:

TBD Applied Machine Learning (QBS)

150 hr/yr

Graduate Level:

2022	Participation in Scientific Research (QBS 195)	150 hr/yr
2022	Master's Capstone Experience (QBS 185)	150 hr/yr

Lectures:

2020	Introduction to Python (QBS 146)	2 hr/yr
2021	Introduction to Neural Networks (QBS 177)	2 hr/yr
2021	Application of Hierarchical Bayesian Methods to Machine Learning (QBS 122)	3 hr/yr
2021	Machine Learning in Pathology (QBS 110)	3 hr/yr
2021	R Software Packaging (QBS 181)	3 hr/yr
2022	Introduction to Neural Networks (QBS 177)	2 hr/yr

Supervised Teaching:**Graduate Level:**

2019	Foundations of Biostatistics (QBS 120)	150 hr/yr
2020-2021	Statistical Learning for Big Data (QBS 177)	150 hr/yr
2021	Hierarchical Bayesian Modeling (QBS 122)	150 hr/yr

Graduate Workshop:

2020	Fundamentals of Bioinformatics and High-Performance Computing	3 hr/yr
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C. UNDERGRADUATE MEDICAL EDUCATION: N/A**D. GRADUATE MEDICAL EDUCATION: N/A****E. MULTIDISCIPLINARY / INTERDEPARTMENTAL:**

2021	Mentorship Ethics Discussion Panelist	3 hr/yr
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X. RESEARCH ADVISING/MENTORING:**Program Director, EDIT (Emerging Diagnostic and Investigative Technologies)**

600hrs/yr

DPLM's newly established EDIT Lab sponsors highly qualified high school students to participate in a 10-week remote internship exploring research topic in digital pathology, machine learning and statistics. Through a series of lectures, guided projects and IRB supported basic research, students develop algorithms to explore various diagnostic spaces in pathology from cancer detection, to gigapixel image manipulation to text prediction. Undergraduate, Master's and medical students have participated in the ongoing year-round internship program. Joshua Levy and Louis Vaickus manage and organize the internship as Co-PI's. At the end of the 10-week program, internship culminates with a presentation to the DPLM faculty, residents and technical staff. Six interns have manuscripts in pre-print and submitted to journals; two have been published (Azher, Vattikonda). The 2020 internship was so popular that we were able to recruit over 25 new interns for 2021 with many alumni returning to give selected lectures and mentor incoming students. A total of 30 new high school students will join the 2022 cohort.

HIGH SCHOOL STUDENTS:**2020 Summer Cohort**

2020	Ajay Prabhakar	EDIT Summer Intern	Morphology Hierarchy
2020	Kaie Yang	EDIT Summer Intern	Secure Data Encryption
2020	Richard Zhan	EDIT Summer Intern	Virtual Staining
2020-Present	Sumanth Ratna	EDIT Summer Intern	Segmentation
2020-2021	Harsha Harish	EDIT Summer Intern	Cell/Tissue Clustering
2020-2021	Nishitha Vattikonda	EDIT Summer Intern	Natural Language Processing

2021 Summer Cohort

2021-Present	Sachin Kumar	EDIT Summer Intern	3D Tissue Modeling
2021-Present	Ramya Reddy	EDIT Summer Intern	Morphological-Molecular Alteration
2021-Present	Ram Reddy	EDIT Summer Intern	Morphological-Molecular Alteration
2021-Present	Akshat Alok	EDIT Summer Intern	Omics Deep Staging Models
2021-Present	Zarif Azher	EDIT Summer Intern	Multimodal Integration
2021-Present	Andrew Wang	EDIT Summer Intern	Cellular Hierarchy
2021-Present	Akash Pamal	EDIT Summer Intern	Surgical Cell Modeling
2021-Present	Irfan Nafi	EDIT Summer Intern	Surgical Cell Modeling
2021-Present	Tarushii Goel	EDIT Summer Intern	Surgical Cell Modeling
2021-Present	Abhinav Angirekula	EDIT Summer Intern	Surgical Cell Modeling
2021-Present	Cristian Clewis	EDIT Summer Intern	Tissue Staging Models
2021-Present	Abena Kyereme-Tuah	EDIT Summer Intern	Tissue Staging Models
2021-Present	Sameeksha Garg	EDIT Summer Intern	Tissue Staging Models
2021-Present	Sagar Gupta	EDIT Summer Intern	Omics Deep Staging Models
2021	John Kim	EDIT Summer Intern	3D Tissue Modeling
2021	Aryan Kumawat	EDIT Summer Intern	3D Tissue Modeling
2021	Adnan Murtaza	EDIT Summer Intern	3D Tissue Modeling
2021-Present	Edward Zhang	EDIT Summer Intern	Ink Imputation Histology
2021-Present	Taein Kim	EDIT Summer Intern	Ink Imputation Histology
2021-Present	Nikhil Kalidasu	EDIT Summer Intern	Cell Detection
2021	Mohan Liu	EDIT Summer Intern	Stain Preference
2021-Present	Michael Cheng	EDIT Summer Intern	Cytology Translation

2022 Summer Cohort

2022-Present	Utkarsh Goyal	EDIT Summer Intern	TBD
2022-Present	Sanjay Jacob	EDIT Summer Intern	TBD
2022-Present	Anish Suvarna	EDIT Summer Intern	TBD
2022-Present	Eric Feng	EDIT Summer Intern	TBD
2022-Present	Michael Fatemi	EDIT Summer Intern	TBD
2022-Present	Ananya Gottumukkala	EDIT Summer Intern	TBD
2022-Present	Aryaman Khanna	EDIT Summer Intern	TBD
2022-Present	Ram Vempati	EDIT Summer Intern	TBD
2022-Present	Nikhil Pesala	EDIT Summer Intern	TBD
2022-Present	Sameer Gabbita	EDIT Summer Intern	TBD
2022-Present	Neha Reddy	EDIT Summer Intern	TBD
2022-Present	Audhav Durai	EDIT Summer Intern	TBD
2022-Present	Christal Wang	EDIT Summer Intern	TBD
2022-Present	UnCheng Leong	EDIT Summer Intern	TBD
2022-Present	Hyunjae Chung	EDIT Summer Intern	TBD
2022-Present	Sayan Bhattacharya	EDIT Summer Intern	TBD
2022-Present	Will Crampton	EDIT Summer Intern	TBD
2022-Present	Amruta Rajeev	EDIT Summer Intern	TBD
2022-Present	An Le	EDIT Summer Intern	TBD
2022-Present	Nancy Hernandez	EDIT Summer Intern	TBD
2022-Present	Ananya Pamal	EDIT Summer Intern	TBD
2022-Present	Rushank Goyal	EDIT Summer Intern	TBD

A. UNDERGRADUATE

Dartmouth College, Hanover NH

2019-Present	Jason Zavras - Presidential Scholar	Computational Stain Normalization Intra-institutional digital stain preference
2020-Present	Jason McFadden	Evaluation AI Technologies

2021	Osezele Okoruwa	Stain Preference
2021-2022	Jean Yuan	Medical Informatics
2021-2022	Daniel Dong	Medical Informatics
2022-Present	William Chen	Data Evaluation
2022-Present	John Zavras	Spatial Profiling

Middlebury College

2021-Present	Jack Greenburg	Natural Language Processing for CPT Code Billing
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University of Michigan

2021-Present	Carly Miles	Medical Informatics
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Other Institutions

2022-Present	Deepanshu Mody	DNAm Aging
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B. GRADUATE:

2020-Present	Brody McNutt	Master's Student (QBS)	Secure Data Encryption
2020-2022	Julian Gullett	Master's Student (QBS)	Evaluation AI Technologies
2021-Present	Yunrui Lu	Master's Student (QBS)	Natural Language Processing
2021-Present	Uhuru Kamau	Master's Student (QBS)	Natural Language Processing
2021-Present	Shuyang Lu	Master's Student (QBS)	Natural Language Processing
2021-Present	Taylor Hudson	Master's Student (QBS)	CRISPR
2021-Present	Sean McOsker	Master's Student (QBS)	Model Explainability
2022-Present	Natt Chan	Master's Student (QBS)	Pathology
2022-Present	Ojas Ramwala	NYU Master's Graduate	Digital Pathology
2021	Elizabeth Anderson	PhD Rotation (QBS)	Placenta Histology
2021-2022	Jeff Joseph	PhD Rotation (QBS)	Spatial Correlations
2022	Peiyang Hua	PhD Rotation (QBS)	NLP

C. MEDICAL STUDENTS:

2020-2021	Eren Veziroglu	Medical Student	Digital Spatial Profiling
2020-2021	Mustafa Nasir Moin	Prospective Medical	Digital Spatial Profiling
2021-Present	Marietta Montivero	Geisel MD PhD Student	Surgical Excision
2022-Present	Raven Bennett	Geisel MD Student	Microbiome
2018-2021	Christian Haudenschild	Medical Student Minnesota	Federated Data Networks

D. RESIDENTS/FELLOWS:

2019-2021	Robert Hamilton	Pathology Resident/Fellow	Auto-Machine Learning
2019-2021	Chris Jackson	Pathology Resident/Fellow	Virtual Immunofluorescence
2020-2021	Ryan Glass	Pathology Resident/Fellow	Bayesian Cytology Prediction
2022-Present	Abdol Aziz	Prospective Resident	Graph Neural Networks

E. RESEARCH ASSOCIATES:

2018-2021	Jorge Lima	Data Scientist	Pressure Injury Prediction
2020-Present	Max Levis	Assistant Professor	NLP Suicide Risk

F. FACULTY: N/A

XI. ADVISING / MENTORING:

A. UNDERGRADUATE STUDENTS: N/A

B. GRADUATE STUDENTS: N/A

C. MEDICAL STUDENTS: N/A

D. RESIDENTS/FELLOWS/RESEARCH ASSOCIATES: N/A

XII. ENGAGEMENT, COMMUNITY SERVICE / EDUCATION:

2015	American Heart Association Advocacy, Advocacy Intern, Oakland, CA
2011-2019	Special Olympics, Head Coach, Walnut Creek, CA
2015-2018	Coaching Corps, King Middle School, Basketball Coach, Berkeley, CA
2015-2018	Coaching Corps Berkeley Chapter Executive Recruitment Coordinator, Berkeley, CA
2015-2017	American Foundation for Suicide Prevention, Outreach Coordinator, Berkeley, CA
2011-2016	Telescope Makers Workshop, Astronomy Docent and Telescope Maker, Mount Diablo Astronomical Society, Berkeley, CA
2015-2018	National Suicide Prevention Lifeline, American Foundation for Suicide Prevention, Oakland, CA
2019	New Hampshire Academy of Sciences Mentor, Lyme, NH
2019	New Hampshire Special Olympics Volunteer, Lyme, NH

XIII. RESEARCH ACTIVITIES:

Present:

2021-	Prouty Grant <i>CRISPR Targeting of Merkel Cell Polyomavirus</i>	Levy J (Co-PI)	\$50,000
2020-	Prouty Grant <i>Validation of In-Vivo Imaging (20%)</i>	LeBeouf M (Co-PI)	\$50,000
2021-	Sun Damage Reversal Therapies (COBRE Pilot)	Levy J (PI)	\$50,000
2022-	Dartmouth Hitchcock ORO Capital Investment, <i>Pathology Advanced Computational Environment</i>	Levy J (Co-PI)	\$205,000
2021-	IDeA States Pediatric Clinical Trials, Biostatistics Consulting	Levy J (Co-I)	\$5,000 (directs)
2020-	Dartmouth-Hitchcock Department of Psychiatry, Tucker Award	Levis M (Co-I)	\$12,000 (directs)
2021-	Richard Baughman Scholar Award	Levy J (PI)	\$300,000
2022	Student Digital Pathology Laboratory 2.0 (Neukom)	Levy J (Co-PI)	\$18,000
2022	Stephen Marsh Tenney, M.D., Medical Student Fellowship Award Co-Mentor		\$30,000
2022	Hitchcock Foundation Pilot, Komal Satti <i>How Obesity Influences the Immune Repertoire in Children. A Pilot Study</i>	Levy J (Co-I)	\$40,000

Past:

2016	Online Mental Health Education at UC Berkeley	Levy J (Co-PI)	\$30,000
2019	Burroughs Wellcome Fund, Big Data Life Sciences Fellow 100% effort	Levy J (PI)	\$60,000
2020	I-Corps Business Development (33% effort)	Levy J (Co-PI)	\$3,000
2020	COBRE CQB Paper Travel Award	Levy J (PI)	\$2,000
2021	Dartmouth Entrepreneurs Startup Competition Finalist (33%)	Levy J (Co-PI)	\$5,000
2020	Dartmouth Hitchcock ORO Capital Investment, <i>QDP-Alpha (33% effort)</i>	Levy J (Co-PI)	\$160,000
2020	Neukom Institute CompX <i>Virtual Flow Cytometry (20% effort)</i>	Sriharan A (Co-I)	\$40,000
2020	Neukom Institute CompX <i>Virtual Laboratory for Students (95% effort)</i>	Levy J (Co-PI)	\$25,000
2020	Quantitative Biomedical Sciences, TA Fellowship 100% effort	Levy J (PI)	\$5,000
2021	Single Cell Genomics Core Visium Pilot Funds	Levy J (Co-PI)	\$10,000

Pending:

2022	Opening DOORS to Low-Cost Library Synthesis for CRISPR Off-Target Screening	Levy J (PI)	\$40,000
2022	Deep Learning Histomorphological Choriocarcinoma Triage System (American Cancer Society)	Levy J (PI)	\$30,000
2022	Development of a crowd peer review platform for transdisciplinary computational research	Levy J (Co-PI)	\$40,000
2021	Advancing Clinical Translational Science through Validation of Emerging Diagnostic Artificial Intelligence Technologies	Levy J (PI)	\$1,250,000
2022	TBD	Levis M (Co-I)	\$18,000 (directs)
2022	Predicting colon cancer metastasis through spatial molecular characterization of the tumor immune microenvironment	Levy J (PI)	\$1,250,000
2022	Evaluating choriocarcinoma risk factors in first trimester miscarriages using quantitative deep learning histological assessments of abnormal villous morphology	Levy J (PI)	\$30,000

XIV. PROGRAM DEVELOPMENT:

Aug 2018 – present:

EDIT (Emerging Diagnostic and Investigative Technologies)

Research Program, Department of Pathology and Laboratory Medicine, DHMC, Lebanon, NH

- Investigating emerging diagnostic deep learning technologies: molecular, histopathological, text, and image (Founder EDITor)
- Collaborating with other EDITors to automate diagnostic technologies
- User-centered design and validation.
- Machine-learning arm co-lead, whole genome sequencing
- Internship program co-head: conception, mentorship, skill development

XV. ENTREPRENEURIAL ACTIVITIES:

Related to the design of deep learning techniques for the analysis of whole slide images and high-resolution anorectal manometry devices (ongoing).

- I-Corps Incubator
- Dartmouth Innovations Accelerator
- DRIVEN Accelerator
- Dartmouth Entrepreneurs Startup Competition Finalists
- 3 Patents Pending

XVI. MAJOR COMMITTEE ASSIGNMENTS:

International: N/A

National: N/A

Institutional:

2018-

2021 Synergy Biostatistics Consultant, Geisel School of Medicine at Dartmouth, Hanover, NH

2019-

2021 Burroughs Wellcome Fund Fellow, Geisel School of Medicine at Dartmouth, Hanover, NH

2018-

2020 Graduate Student Council Executive, Dartmouth College, Hanover, NH

2021- Quantitative Biomedical Sciences Ad-Hoc Reviewer Master's Admission Committee, Hanover, NH

2022- Biostatistics and Bioinformatics Shared Resource Faculty, Hanover, NH

XVII. MEMBERSHIPS, OFFICE, AND COMMITTEE ASSIGNMENTS IN PROFESSIONAL SOCIETIES:

2017-

2019 Artificial Intelligence (AI) Enthusiast Club, Walnut Creek, CA, Founder

2018-

2019 QuantBlitz Data Science Club, Hanover, NH, Member

2019 Epidemiology Students Club, Hanover, NH, Member

2020-

2021 Natural Language Processing (NLP) Consultant, Department of Psychiatry, Hanover, NH

2019-

2020 International Society for Computational Biology and Bioinformatics

2022 Association for Computing Machinery

2021- Quantitative Biomedical Sciences Ad-Hoc Reviewer Master's Admission Committee, Hanover, NH

2022- Norris Cotton Cancer Center, Cancer Population Sciences

2022- Norris Cotton Cancer Center, Biostatistics and Bioinformatics Shared Resource

XVIII. EDITORIAL BOARDS:

2021- Frontiers in Medical Technology

present Co-Guest Editor

XIX. JOURNAL REFEREE ACTIVITY:

Crohn's and Colitis 360 (x1)

Pacific Symposium on Biocomputing (x3)

BMC Biomedical Medical Research Methodology (x1)

Laboratory Investigation (x2)

PLOS Computational Biology (x2)

Cancer Cytopathology (x1)

Computational Statistics & Data Analysis (x1)

Computerized Medical Imaging and Graphics (x2)

Computer Methods and Programs in Biomedicine (x2)

Clinical Epigenetics (x2)

Journal of Translational Medicine (x1)

Neural Processing Letters (x1)

All Life (x1)

BMC Medical Informatics (x1)

BMC Bioinformatics (x1)

The Lancet (x1)

Nature Communications (x1)

Nature Scientific Reports (x1)

XX. AWARDS AND HONORS:

2015-2017 UC Berkeley, Dean's List (Fall 2015, Spring 2016)
Honors (All Semesters); Highest Distinction; Cum. GPA: 3.97 / 4.0; Major GPA: 3.98 / 4.0

2020 Geisel School of Medicine at Dartmouth College
Center for Quantitative Biology Travel Award \$2,000

2020 BIOSTEC 2020 Comp2Clinic Workshop, Best Paper

2021 Modern Pathology Article Top Pick of January 2021

XXI. INVITED PRESENTATIONS:

(*) those presentations to which an individual invitation was extended

(#) those presentations that were meetings where a poster/talk, was presented at a large society meeting)
(^) if the talk/presentation was applicable as a CME activity.

International:

2020 Preliminary Evaluation of Generative Image Translation Technologies for Histopathology
Podium presentation (Best Paper Award), Biomedical Engineering Systems and Technologies
(Biostec) 2020 C2C Workshop, Valletta, Malta

National

2017 Snapshots of genome evolution and population dynamics in the allopolyploid grass *Brachypodium hybridum*. Poster, American Society of Plant Biologists (ASPB), Honolulu, HI

2020 PathFlowAI: Scalable Digital Pathology
Pacific Symposium Biocomputing 2020, Kona, HI

2021 Topological Feature Extraction for Whole Slide Images with Graph Neural Networks
Podium Talk, Pacific Symposium Biocomputing 2021, Kona, HI

2021 Digital spatial profiling identifies novel biomarkers for locally invasive tumors, *Association for Molecular Pathology 2021*, Virtual

2022 Mixed effects machine learning on spatially localized immuno-oncology markers for colon metastasis prediction
Pacific Symposium Biocomputing 2022, Kona, HI

Local/Regional

2018 Where are Your Bug's Genes and What do They Do? Workflow Automation and Machine Learning for Gene Annotation and Function. Zymergen, Emeryville, CA & Seattle, WA

2019 Machine Learning Analytics of Pancancer Methylation Microarray and RNA-sequencing Profiles at Susceptibility Loci. Poster, Celebration of Biomedical Research at Dartmouth (CBRaD), Hanover, NH

2019 MethylNet: A Modular Deep Learning Approach to DNA Methylation Prediction
Quantitative Biomedical Sciences: (QBS) Retreat and NCCC Retreat, Hanover NH

2020 PathFlowAI: Scalable Digital Pathology
Dartmouth-Hitchcock Retreat, Hanover NH

2020 Improving Data Representation Software for DNAm and Histopathology,
Research in Progress, QBS, Hanover, NH

2020 Mortality Prediction from Satellite Imagery
Burroughs Wellcome Fellowship, Hanover, NH

2020 Automating the Paris System
Burroughs Wellcome Fellowship, Hanover, NH

2021 Opportunities for Machine Learning Research in Pathology and Dermatology
Department of Dermatology, Hanover, NH

2021 Introduction to Neural Networks, Guest Lecture for QBS Class, Hanover NH

- 2021 Application of Hierarchical Bayesian Methods for Medical Artificial Intelligence, Guest Lecture for QBS Class, Hanover NH
- 2021 Uncertainty in Disease Staging, Research in Progress, QBS, Hanover NH
- 2021 Emerging Diagnostic and Investigative Technologies: Validation of Deep Learning Technologies for DNA Methylation and Histopathology, Thesis Seminar Talk, Hanover NH
- 2021 Emerging Machine Learning Methods in Digital Pathology, EDIT Seminar Talk, Hanover NH
- 2021 Opportunities for Machine Learning Research in Pathology, QBS, Hanover NH
- 2021 R Software Packaging, Guest Lecture for QBS Class, Hanover NH
- 2021 Research Overview, Department of Epidemiology, Hanover NH
- 2021 Mixed effects machine learning on spatially localized immuno-oncology markers for colon metastasis prediction, NCCC Retreat, Lebanon NH
- 2022 Introduction to Machine Learning and Research Opportunities in Pathology and Dermatology, Geisel School of Medicine Medical Student AI Interest Group, Lebanon NH
- 2022 Rapid 100% Margin Assessment through AI in the Surgical Pathology Setting, Melanoma Retreat, DHMC, Lebanon NH
- 2022 EDIT Machine Learning Internship Program, Dermatology Research Night, DHMC, Lebanon NH
- 2022 Introduction to Neural Networks, Guest Lecture for QBS Class, Hanover NH
- 2022 Advancing Clinical Translational Sciences through Validation of Emerging Artificial Intelligence Technologies, Cancer Population Sciences, Hanover NH
- 2022 Medical AI Opportunities, Oakland Tech, Oakland CA

XXII. BIBLIOGRAPHY:

A. Peer-reviewed publications in print or other media

PhD Thesis:

1. **Levy J.** Emerging Diagnostic and Investigative Technologies: Validation of Deep Learning Technologies for DNA Methylation and Histopathology. 2021

Reviews:

1. **Levy J, Vaickus L.** Applications of AI in Anatomic Pathology. *Advances in Molecular Pathology*, 2021

Book Chapters:

1. **Levy J, Vaickus L.** Applications of AI in Molecular Pathology (Chapter Proofing)

Original articles:

1. **Co-first:** *Gordon SP, * **Levy J**, Vogel JP. PolyCRACKER, a robust method for the unsupervised partitioning of polyploid subgenomes by signatures of repetitive DNA evolution. *BMC Genomics*.

2. **Levy J**, Titus A, Salas L, Christensen B. PyMethylProcess - convenient high-throughput preprocessing workflow for DNA methylation data. *Bioinformatics*. 2019.
3. **Levy J**, Titus AJ, Petersen CL, Chen Y, Salas LA, Christensen BC. MethylNet: An Automated and Modular Deep Learning Approach for DNA Methylation Analysis. *BMC Bioinformatics*. 2020.
4. **Levy J**, Salas LA, Christensen BC, Sriharan A, Vaickus LJ. PathFlowAI: A High-Throughput Workflow for Preprocessing, Deep Learning and Interpretation in Digital Pathology. *Pacific Symposium on Biocomputing*, 2020;25:403–14.
5. **Levy J**, O'Malley AJ. Don't Dismiss Logistic Regression: The Case for Sensible Extraction of Interactions in the Era of Machine Learning. *BMC Medical Research Methodology*. 2020.
6. **Levy J**, et al. Preliminary Evaluation of the Utility of Deep Generative Histopathology Image Translation at a Mid-Sized NCI Cancer Center. *Proceedings of the 13th International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSTEC 2020) - Volume 3: BIOINFORMATICS*
7. **Levy J**, et. al. Topological Feature Extraction of Whole Slide Images with Graph Neural Networks. *Pacific Symposium on Biocomputing*. 2021.
8. **Levy J**, et. al. A Large-Scale Internal Validation Study of Unsupervised Virtual Trichrome Staining Technologies on Non-alcoholic Steatohepatitis Liver Biopsies. *Modern Pathology*, 2021
9. **Levy J**, Chen Y, et al. Biologically Motivated Organization of DNAm Neural Networks, Inspired by Capsule Networks, NPJSBA, 2021.
10. **Levy J**, et. al. Journey across Epidemiology's Third Variables: An Anesthesiologist's Guide for Successfully Navigating Confounding, Mediation, and Effect Modification. *BMJ RAPM*, 2021.
11. **Levy J**, Lebeaux, R. M., Hoen, A. G., et al. Using Satellite Images and Deep Learning to Identify Associations Between County-Level Mortality and Residential Neighborhood Features Proximal to Schools: A Cross-Sectional Study. *Frontiers in Public Health* 9, 1652 (2021).
12. **Levy J**, Bobak C, et. al. Mixed Effects Machine Learning Models for Colon Cancer Metastasis Prediction using Spatially Localized Immuno-Oncology Markers. *Pacific Symposium on Biocomputing*. 2022.
13. **Levy, J.**, Vattikonda, N., Haudenschild, C., Christensen, B. & Vaickus, L. Comparison of Machine Learning Algorithms for the Prediction of Current Procedural Terminology (CPT) Codes from Pathology Reports. *Journal of Pathology Informatics* (2022)
14. Co-first: *Kelliher, M., ***Levy, J.**, *Nerenz, R., *et.al.* Comparison of Symptoms and Antibody Response Following Administration of Moderna or Pfizer SARS-CoV-2 Vaccines. *Archives of Pathology & Laboratory Medicine* (2022).
15. Azher, Z. L., Vaickus, L. J., Salas, L. A., Christensen, B. C. & **Levy, J. J.** *Development of Biologically Interpretable Multimodal Deep Learning Model for Cancer Prognosis Prediction*. *ACM/SIGAPP SAC* 2022.
16. Haudenschild, C., Vaickus, L. & **Levy, J.** *Configuring a federated network of real-world patient health data for multimodal deep learning prediction of health outcomes*. 2021. *ACM/SIGAPP SAC* 2022.

17. Copeland-Halperin L, Reategui M, **Levy J**, et al. Does the Timing of Postoperative Showering Impact Infection Rates? A Systematic Review and Meta-Analysis. *JPRAS*. 2020.
18. Gordon SP, Moreira BC, **Levy J**, et. al. Gradual polyploid genome evolution revealed by a pan-genomic analysis of *Brachypodium hybridum* and its diploid progenitors. *Nature Comm*. 2020.
19. Brady R, **Levy J**, et. al. The mediating effects of perceived vulnerability to disease in the relation between disgust and contamination-based OCD. *J Anxiety Disord*. 2021
20. Copeland-Halperin L, Reategui M, **Levy J**, et. al. MRI Screening after Silicone Implant-based Breast Surgery: A Survey of Patient Awareness of and Adherence with FDA Recommendation. *Plastic and Reconstructive Surgery*. 2022
21. Glass, R. E., Marotti, J. D., Kerr, D. A., ..., **Levy, J. J.**, et al. Using molecular testing to improve the management of thyroid nodules with indeterminate cytology: an institutional experience with review of molecular alterations. *Journal of the American Society of Cytopathology* (2021).
22. Glass, R. E., **Levy, J. J.**, Motanagh, S. A., et al. Atypia of undetermined significance in thyroid cytology: Nuclear atypia and architectural atypia are associated with different molecular alterations and risks of malignancy. *Cancer Cytopathology* 129, 966–972 (2021).
23. Azizgolshani, N., Petersen, C. L., Chen, Y., **Levy, J.J.**, et al. DNA 5-hydroxymethylcytosine in pediatric central nervous system tumors may impact tumor classification and is a positive prognostic marker. *Clinical Epigenetics* (2021).
24. Torres, V., Hodge, S., Chen, E., **Levy, J.** & Vaickus, L. Rapid tumor margin analysis using paired-agent imaging to guide Mohs micrographic surgery. in *Proc. of SPIE Vol* vol. 11943 1194304–1.

Manuscripts in review:

1. **Levy J**, Lima J, et al. A Machine Learning Personalized Pressure Injury Prediction Model
2. **Levy J**, et. al. Pathflow-MixMatch for Whole Slide Image Registration: An Investigation of a Segment-Based Scalable Image Registration Method
3. **Levy J**, et. al. GCN4R: Latent Position of Actors in Social Networks with Graph Neural Networks
4. **Levy J**, Christensen C, Vaickus L, Shah E. A Deep Learning Method for Prediction of Abnormal Anorectal Manometry Exams
5. **Levy J**, Bobak C, et. al. Bridge Category Models: Development of Bayesian Modelling Procedures to Account for Bridge Ordinal Ratings for Disease Staging
6. **Levy J**, Bobak C, et. al. Application of Hierarchical Bayesian Bridge Modeling Approaches for Estimating Inter-Rater Variability in Fibrosis Staging
7. **Levy J**, Bobak C, et. al. An Improvement to the Virtual Trichrome Assessment through Bridge Category Models
8. **Levy J**, et. al. Uncovering Additional Predictors of Urothelial Carcinoma from Voided Urothelial Cell Clusters Through a Deep Learning Based Image Preprocessing Technique

9. **Levy J**, et. al. Large-Scale Longitudinal Comparison of Urine Cytological Classification Systems Reveals Potential Early Adoption of The Paris System Criteria
10. **Levy J**, LeBoeuf M, Christensen C, Vaickus L. ArcticAI: A Deep Learning Platform for Rapid and Accurate Histological Assessment of Intraoperative Tumor Margins
11. McNutt B, ..., **Levy J**. Federated Learning Working Group
12. Levis M, **Levy J**, et. al. Dynamic Topic Modeling Reveals Evolving Patterns of Suicidal Ideation in Veteran Population
13. Levis M, **Levy J**, et. al. Machine Learning Modeling to Predict Suicide Amongst Veterans
14. Levis M, **Levy J**, et. al. Machine Learning Modeling to Predict Suicide Amongst Veterans, Matched
15. Kerr D, Goyette E, **Levy J**, et. al. Mesenchymal Molecular Assessment
16. Hong J, Quon R, Song Y, Xie T, **Levy J**, et. al. Seizure onset in the supplementary motor area drives re-mapping of the mesial frontal motor areas.
17. Copeland-Halperin L, Reategui M, **Levy J**, et. al. A Systematic Review and Meta-Analysis of Factors Pertaining to Gastronomy Tube Placement
18. Copeland-Halperin L, Reategui M, **Levy J**, et. al. Internal Validation of Predictive Model for Gastronomy Tube Placement and Complications
19. Farrel K, **Levy J**, et. al. Vaginal Birth after Cesarean: Adoption of a Regional Guideline

Select manuscripts in preparation:

1. **Levy J**, et. al. HistoBayes: An Interactive Web Application for Bayesian Deep Learning on Histopathology, with Applications in Cytopathology
2. **Levy J**, et. al. Hyperbolic MethylMaps: Hyperbolic Embeddings Pseudotime Bulk DNA Methylation
3. **Levy J**, et. al. InteractMethylXtract: Random Forest Selected DNA Methylation Interactions
4. **Levy J**, Haudenschild C, et. al. MetaCRACKER: Deep Clustering of Metagenomic Reads
5. **Levy J**, Christensen C, Vaickus L. Large-Scale Prospective Validation of the AutoParis System
6. **Levy J**, Christensen C, Vaickus L. Bladder Cancer Recurrence
7. **Levy J**, LeBoeuf M, Christensen C, Vaickus L. Quality Assessment Method
8. **Levy J**, Christensen C, Vaickus L, Shah E. Multicenter Prospective Validation of Anorectal Manometry AI Technologies
9. **Levy J** *, Ratna S*, et al. PyNuclei: A Software Framework for Nuclei Segmentation
10. **Levy J** *, Harish H*, et al. DeepCellCluster: A Software Framework for Nuclei Clustering
11. **Levy J**, Glaser A, et. al. DNA Methylation Brain Cell-Type Adjustment and Meta-Analysis Reveals Important Markers of Huntington's Disease
12. **Levy J**, et. al. Turing Test 2.0: Improving Clinical Applicability of Visual Inspection of Virtual Staining Technologies
13. **Levy J**, et. al. Applications of Digital Spatial Profiling for the Assessment of Colorectal Cancer Metastasis
14. **Levy J**, et. al. On the Potential for Selection Bias using Digital Spatial Profiling Technologies
15. Anderson E, ..., **Levy J**. Product of Conception Assessment
16. McNutt B, ..., **Levy J**. Federated Learning Working Group for Pathology
17. McNutt B, ..., **Levy J**. HistoCrypt: A Federated Learning Platform for Pathology
18. Gullet J, ..., **Levy J**. Hierarchical Bayesian Analyses in Pathology

19. Zavras J, ..., **Levy J**. Impact of Stain Normalization on Deep Learning Models
20. Zhang E, ..., **Levy J**. Green Ink Imputation with Graph Neural Networks
21. Greenburg J, ..., **Levy J**. NLP Application to Detect Hospital Underbilling
22. Zheng Z, **Levy J**, et. al. Cell Type Independent Clock
23. Satti K, ..., **Levy J**, et. al. Inflammatory Markers Predictive of Changes in BMI
24. Satti K, ..., **Levy J**, et. al. BMI effect modification with Vitamin D
25. Satti K, ..., **Levy J**, et. al. BMI, Microbiome, T Cell Study
26. Kerr D, Goyette E, **Levy J**, et. al. Decalcification Protocol with Optimal Timing and Maximal Tissue Preservation for High-Quality Histologic Examination and Molecular Analysis
27. Kerr D, Goyette E, **Levy J**, et. al. Digital Spatial Profiling Dupuytren
28. Romero A, **Levy J**, et. al. Platelets
29. Ondrasik R, **Levy J**, et. al. RBC Utilization
30. Dunkle A, **Levy J**, et. al. Influenza Test Positivity Rates From 2019-2020 with the Onset of Social Distancing Due To COVID
31. Glass R, **Levy J**, et. al. Comparing NC Ratios between Eyeball and Diameter-Based Measurements
32. Montagnese B, Levy J, et al., Machine learning prediction of neurocognitive deficits using central auditory tests
33. Greene C, ..., **Levy J**. Opportunities and obstacles for deep learning in biology and medicine, 2nd update.

Letters to the Editor: N/A

B. Other scholarly work in print or other media including editorially-reviewed publications (e.g., Op-Ed pieces, Letters to the Editor), print resources (e.g., workshops) and electronic resources (e.g., MOOCs, educational websites, modules, videos, virtual patients): N/A

C. Abstracts:

Presented at National Meetings:

1. Glass R, **Levy J**, et. al. Atypia of Undetermined Significance in Thyroid Cytology: Nuclear and Architectural Atypia are Associated with Different Molecular Alterations and Risks of Malignancy (abstract)
2. Glass R, **Levy J**, et. al. Utilizing molecular testing to improve the management of thyroid nodules with indeterminate cytology: an institutional experience (abstract)
3. Copeland-Halperin L, ... **Levy J**, ... et. al. Oral Cancer Patients Undergoing Resection with Free Flap Reconstruction: Predictors of Gastrostomy Tube Placement, *STARS* 2021
4. Stewart T, ..., **Levy J**, ... et. al. Predictors of Gastronomy Tube Placement for Patients Undergoing Resection of Head and Neck Cancer with Flap-based Reconstruction: Protocol for Systematic Review and Meta-Analysis. *ACSVT* 2021
5. Copeland-Halperin L, ..., **Levy J**, ..., et.al. Indications for Gastrostomy Tube Placement in Oral Cancer Patients Undergoing Resection with Immediate Free Flap Reconstruction. *AHNS* 2021
6. Copeland-Halperin L, ..., **Levy J**, ..., et.al. Does the Timing of Postoperative Showering Impact Infection and Complication Rates? *NESPRS* 2020
7. Barney RE, Palisoul SM, **Levy J**, Vaickus LJ, Lin CC, Tsongalis GJ, Zanazzi G. Digital Spatial Profiling Identifies Novel Biomarkers for Locally Invasive Tumors. *J Molec Diagn* 2021;23, 1648 (TT31)
8. Satti, K, Levy, J, et al. Effect of Vitamin D on the Relationship Between TNF- α and BMI. Pediatric Academic Societies (PAS) 2022 Meeting

Presented at Local Meetings:

1. Farrel K, **Levy J**, et. al. Vaginal Birth After Cesarean Section in Northern New England: Assessing the Adoption and Impact of Regional Guidelines, Dartmouth Hitchcock Medical Center, Lebanon, NH
2. Catalan P, ..., Gordon S, **Levy J**, et. al. Integrative Genomic Characterization of the Brachypodium Polyploid Model to Unravel Bases of Success of Polyploidy in Flowering Plants, DOE JGI, Berkeley, CA

3. Chen Y, **Levy J**, et. al., Machine Learning Analytics of Pan-cancer Methylation Microarray and RNA-sequencing Profiles at Susceptibility Loci, CBRaD 2019

XXIII. Personal Statement:

My formal background and training are in Physics and Quantitative Biomedical Sciences, the latter of which is an interdisciplinary data science discipline at the intersection of Epidemiology, Biostatistics and Bioinformatics. My experience in Physics motivated me to think abstractly about how information could be represented using n-dimensional objects, which has been of great benefit as my research shifted towards applied machine learning. Prior to my PhD training, I learned to develop, implement and deploy over one hundred sophisticated reproducible, containerized genomics and bioinformatics workflows at scale in High Performance Computing (HPC) computing environments as a software developer/engineer at both the Lawrence Berkeley National Labs and Zymogen, which instilled in me a mindset of doing public good through high throughput computations. My motivations for my recent career aspirations originated through my work in the San Francisco Department of Public Health (SFDPH), where I witnessed first-hand some of the many challenges associated with implementing new digital technologies in a healthcare setting which was, at times, averse to change and frustrations on behalf of the stakeholders. This inspired me to think more critically about how to engage stakeholders, and now that I am in a position to develop and implement these novel biomedical technologies, I have taken these principles to heart by directly integrating with the stakeholders which I aim to benefit. I served as a Burroughs Wellcome Fellow, which enabled me to build closer relationships with the Department of Pathology. Currently, I serve as an Assistant Professor of the Departments of Pathology and Laboratory Medicine, and Dermatology, an Adjunct Professor of Epidemiology, and faculty in the Quantitative Biomedical Sciences Graduate program. I am one of the founders and the co-director of the Machine Learning arm of the Emerging Diagnostic and Investigative Technologies (EDIT) program. My research group aims to justify the use of digital pathology technologies by developing and validating machine learning technologies and envisioning how they would fit into the clinical workflow. As such, I am in an optimal position to develop and implement digital pathology technologies through effective stakeholder engagement.

To this end, my doctoral work centered around creating standardized, high throughput, open-source software to enable domain experts to extract key insights from two high dimensional data types, DNA Methylation (DNAm) and histopathological data, while validating emerging technologies which could provide immediate benefit to the end user, such as processes to virtually stain tissue to obviate the need for chemical tissue staining. My research group's aims extend beyond these original objectives to include new aims such as: 1) integration of hierarchical Bayesian statistical methodologies with machine learning technologies to provide fair assessments of digital pathology technologies, 2) further methods development and validation of spatial omics technologies, with 3) applications to further understanding of disease pathogenesis and epidemiology. My lab is also developing health informatics technologies that integrate multiple biomedical data modalities, from natural language processing to temporally captured diagnostic codes and lab measurements.

I am committed to the vision of creating a self-sufficient digital pathology program in EDIT through building an independent research lab composed of researchers with diverse, interdisciplinary skillsets. My mentorship experience to date includes launching a year-round internship program which has run successfully for three years. I have directly mentored 40 high school, 10 undergraduate, 9 Master's, 5 medical students, and 4 pathology resident fellows, and am taking on PhD rotation students (3 rotation students and 1 MD PhD student).

I am a member of the Cancer Population Sciences Program, which prides itself on interdisciplinary collaboration amongst basic and physician science researchers, broadly covering the identification of precancerous exposures and somatic alterations elucidated through environmental and molecular epidemiology, using data from translational research to inform our understanding of disease processes and iteratively refine translational work, to the implementation and dissemination of key findings. The research aims of my lab are optimally aligned with these pursuits— my lab is chiefly focused on tackling public health challenges through high throughput computation and building an understanding of which technologies are optimally aligned with stakeholders and thus likely to have a positive impact on the greater community.

Updated by:

Date: