Kathleen Mary Curtius, PhD

Curriculum Vitae

University of California, San Diego
Division of Biomedical Informatics
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Areas of Expertise

General: Mathematical and Computational Biology, Data Science, Cancer Evolution and Epidemiology, Stochastic Processes

Emphasis: Multiscale Cancer Modeling, Translational Bioinformatics, Cancer Screening, Early Detection, Epigenetic Aging

Education

- Ph.D. in Applied Mathematics, University of Washington, Seattle *Aug 2015*
  Thesis: *Multiscale Modeling of Esophageal Adenocarcinoma*
  Advisor: E. Georg Luebeck
- M.S. in Applied Mathematics, University of Washington, Seattle *June 2011*
- B.S. in Mathematics with Highest Honors, University of California, Los Angeles *June 2010*
  Graduated Summa Cum Laude
  Thesis: *Geographic Profiling of Criminal Activity in Los Angeles using Lévy Flights*
  Advisor: George Mohler

Academic Position History

University of California, San Diego

- Assistant Professor, Department of Medicine, *Biomedical Informatics* *July 2020 - Present*
- Full Member, Moores Cancer Center, *Cancer Control Program* *Dec 2023 - Present*
- Associate Member, Moores Cancer Center, *Cancer Control Program* *July 2020 - Dec 2023*

Veterans Affairs (VA) San Diego Healthcare System

- Research Health Scientist (joint appointment with UCSD) *July 2023 - Present*

Centre for Genomics & Computational Biology, Barts Cancer Institute, UK

- UK Research Initiative (UKRI) Rutherford Research Fellow *Feb 2018 – June 2020*
- Postdoctoral Research Fellow
  Evolution and Cancer Laboratory, Supervisor: Trevor A. Graham *May 2016 – Feb 2018*

Division of Gastroenterology, Department of Medicine, University of Washington

- Senior Research Fellow, Supervisor: John M. Inadomi *June 2015 – May 2016*

Public Health Sciences Division, Fred Hutchinson Cancer Research Center

- Postdoctoral Research Fellow Affiliate, Supervisor: E. Georg Luebeck *June 2015 – May 2016*

Department of Applied Mathematics, University of Washington

- National Science Foundation (NSF) Graduate Research Fellow *2011 – 2014*
- Teaching Assistant *Fall 2010*

Funding and Fellowship History

Active research support

- UCSD Health Sciences Academic Senate Grant (PI) *June 2024 - May 2025*
  Title: *Genomic biomarkers that predict gastric intestinal metaplasia progression* $14,936

- NIH National Cancer Institute R01 CA270235 (PI) *Sept 2023 - Aug 2028*
  Title: *Multiscale modeling of spatiotemporal evolution in Barrett's esophagus* $2,907,747

- VA BLRD Data Science Merit Review Award I01 BX005958 (PI) *July 2023 - July 2027*
  Title: *Mathematical Optimization of Surveillance Ages to Intercept colitis-associated Colorectal cancer (MOSAIC)* $1,167,741

- Phathom Pharmaceuticals Research Grant (PI) *Sept 2022 - Sept 2025*
  Title: *Innovative approach to genomic tissue profiling to generate risk prediction models and pathway discovery for gastroesophageal preneoplasia among at-risk patients with gastroesophageal disease and Helicobacter pylori infection* $79,114

- American Gastroenterological Association (AGA) Research Scholar Award (PI) *July 2022 - July 2025*
  Title: *Optimizing gastrointestinal cancer screening and surveillance using mathematical modeling* $200K

- Amy Sobel Foundation Cancer Control Innovation Fund Donation (PI) *Jan 2022*
  Project title: *Developing biomarkers of colorectal cancer risk in North American patients with inflammatory bowel disease using shallow whole genome sequencing* $100K

Completed research support

- Curebound Discovery Grant (co-I) *Feb 2024 - Feb 2025*
  Title: *An Immunologic Driver of Racial Disparity in Esophageal Adenocarcinomas*

- San Diego Digestive Disease Research Center Pilot & Feasibility Award (PI) *Jan 2022 - Jan 2023*
  Title: *Molecular biomarkers for colitis-associated colorectal cancer in patients with inflammatory bowel disease*

- UCSD Health Sciences Academic Senate Grant (PI) *Jan 2022 - Jan 2023*
  Title: *Impact of microbial and genomic evolution on cancer risk in Barrett's esophagus*

- Cancer Research UK (CRUK) Early Detection Primer Award (co-PI) *Oct 2020 - Oct 2021*
  Title: *Understanding the molecular age of Barrett's oesophagus in a population-representative sample of patients spanning paediatric to older age groups*
  Co-PI: Prof. Helen Coleman, Queen's University Belfast, Northern Ireland, UK

- CRUK Early Detection Project Award (co-I) *Mar 2020 - Mar 2023*
  Title: *Molecular biomarkers to predict progression of Barrett's Oesophagus to Oesophageal Adenocarcinoma*
  PI: Dr. Richard Turkington, Queen's University Belfast, Northern Ireland, UK

- CRUK City of London Centre Development Fund Award (co-I) *Mar 2020 - Mar 2021*
  Title: *Tracing and timing pre-cancerous clonal dynamics in normal tissues*
  PI: Dr. Marnix Jansen, University College London

- UKRI/Health Data Research UK Rutherford Research Fellowship (PI) *Feb 2018 - Nov 2021*

- NIH T32 Postdoctoral Gastroenterology Fellowship *2016*
  * awarded at UW GI, declined to accept Barts Cancer Institute postdoctoral offer

- National Science Foundation (NSF) Graduate Research Fellowship *2011 – 2014*

- NSF Research Experience for Undergraduates (REU) Fellowship *Summer 2009*

Awards

- Society for Mathematical Biology Leah Edelstein-Keshet Prize *2025*
  - Awarded to **one woman scientist internationally every 2 years** who has a "demonstrated track record of exceptional scientific contributions to mathematical biology"
  https://www.smb.org/Leah-Edelstein-Keshet-Prize
- Queen Mary University of London Centre for Computational Biology Showcasing Award *2017*
- Society for Experimental Biology Cell Symposium Early Career Travel Award *2016*
- National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) R13 Travel Award *2016*
- Society of Industrial and Applied Mathematics (SIAM) Life Sciences Poster Award *2012*

Research Statement

My lab integrates mathematical models and data science with genomic and clinical data to uncover the evolutionary dynamics of carcinogenesis. My main research focus has been in gastrointestinal (GI) pre-cancers, where screening and surveillance can prevent deadly late stage cancers but current clinical guidelines are suboptimal and inefficient. In Barrett's esophagus (BE), I previously developed a multiscale model of esophageal adenocarcinoma (EAC) formation informed by epidemiological and clinical data that allowed simulations of screening strategies (Curtius et al. *PLoS Comput Biol* 2015) and derivation of optimal screening windows (Curtius et al. *Cancer Res* 2021). Using patient-specific methylation data, I also created an epigenetic clock that enabled measurement of BE tissue age for the first time (Curtius et al. *PLoS Comput Biol* 2016). This work laid the foundation for my interdisciplinary approach to incorporating bioinformatics and mathematical modeling to inform clinical decision-making. Based on our modeling, I discovered that BE is the precursor to nearly all EAC (Curtius et al. *Gut* 2020) and our paper was cited in a recent AGA Clinical Practice Guideline (*Gastroenterol* 2024) to highlight BE as the target at-risk group for EAC prevention efforts. In inflammatory bowel disease (IBD), I worked closely with clinical collaborators to create and validate a statistical model for predicting future colorectal cancer in IBD dysplasia using clinico-pathological features (Curtius et al. *Gut* 2022) and developed a user-friendly web tool for use in shared decision-making (www.UC-CaRE.uk). Since starting the Quantitative Cancer Control (QCC) lab in July 2020, my group has continued to focus on GI cancers and their precursors but have also published modeling studies in melanoma and blood cancers.

The long-term goal of my research is to incorporate cancer evolution processes into novel predictive models that can inform prevention strategies. To achieve this, my lab develops the next generation of computational models and creates/curates the input data (clinical and genomic). This includes our recent work 1) measuring evolutionary dynamics of cells using population genetics (Johnson et al. *Bioinformatics* 2023, Guccione et al. *bioRxiv* 2025), 2) distinguishing host cells from microbial populations present in whole genome sequencing data (Guccione et al. *Nature Commun* 2025); and 3) deriving genetic biomarkers as well as high-quality cancer incidence data in IBD populations (Al Bakir and Curtius et al. *Gut* 2025; Johnson et al. *medRxiv* 2024). The strong collaborative environment at UC San Diego has supported the development of many major projects in my group. Ongoing collaborations with colleagues at UC San Diego, San Diego VA, and other centers have allowed us to combine biomedical informatics, genomics, mathematical modeling, and artificial intelligence approaches to unravel the complexities of cancer initiation with the aim of reducing cancer incidence.

Publications

Preprints ***corresponding author**

35. Guccione C, Sfiligoi I, Gonzalez A, Shaffer JP, Kazachkova M, Weng Y, McDonald D, Shah SC, Minot SS, Paulson T, Grady WM, Alexandrov LB, Knight R, **Curtius K***. (2025) Community assembly modeling of microbial evolution within Barrett's esophagus and esophageal adenocarcinoma. **bioRxiv** doi: 10.1101/2025.01.14.633020 (under review)

34. Johnson B, Bath T, Huang X, Lamm M, Earles A, Eddington H, Dornisch AM, Jih LJ, Gupta S, Shah SC, **Curtius K***. (2024) Large language models for extracting histopathologic diagnoses from electronic health records. **medRxiv** doi: 10.1101/2024.11.27.24318083 (under review)

Journal Articles

33. Al Bakir I[†], **Curtius K*[†]**, Cresswell GD, Grant HE, Nasreddin N, Smith K, Nowinski S, Guo Q, Belnoue-Davis HL, Fisher J, Clarke T, Kimberley C, Mossner M, Dunne PD, Loughrey MB, Speight A, East JE, Wright NA, Rodriguez-Justo M, Jansen M, Moorghen M, Baker AM, Leedham SJ, Hart AL, Graham TA. (2025) Low-coverage whole genome sequencing of low-grade dysplasia strongly predicts colorectal cancer risk in ulcerative colitis. **Gut** 74:740–751 [†]joint first authors

    - "Bowel cancer prediction test for IBD patients 90% accurate", BBC News Article https://www.bbc.com/news/articles/c87d4e2v8l0o *January 2025*

32. Guccione C[†], Patel L[†], Tomofuji Y, McDonald D, Gonzalez A, Sepich-Poore GD, Sonehara K, Zakeri M, Chen Y, Dilmore AH, Damle N, Baranzini SE, Hightower G, Nakatsuji T, Gallo RL, Langmead B, Okada Y, **Curtius K*[#]**, Knight R[#]. (2025) Incomplete human reference genomes can drive false sex biases and expose patient-identifying information in metagenomic data. **Nat Commun** 16:825. [†]joint first authors [#]joint senior authors

31. Johnson B & **Curtius K***. (2024) Digital twins are integral to personalizing medicine and improving public health. **Nat Rev Gastroenterol Hep** 21:740-1

30. Johnson B[†], Shuai Y[†], Schweinsberg J, **Curtius K***. (2023) cloneRate: fast estimation of single-cell clonal dynamics using coalescent theory. **Bioinformatics** 39(9):btad561 [†]joint first authors

29. Lu B, **Curtius K**, Graham TA, Yang Z, Barnes CP. (2023) CNETML: Maximum likelihood inference of phylogeny from copy number profiles of spatio-temporal samples. **Genome Biol** 24:144

28. Talwar J, Laub D, Pagadala M, Castro A, Lewis M, Luebeck GE, Gorman BR, Pan C, Dong FN, Markianos K, Teerlink CC, Lynch J, Hauger R, Pyarajan S, Tsao PS, Morris GP, Salem RM, Thompson WK, **Curtius K**, Zanetti M, Carter H. (2023) Autoimmune Alleles at the Major Histocompatibility Locus Modify Melanoma Susceptibility. **Am J Hum Genet** 110:1-24

27. Guccione C, McDonald D, Fielding-Miller R, **Curtius K**, Knight R. (2023) You are what you excrete. **Nat Microbiol** 8(6):1002-3

26. Patel R[†], **Curtius K[†]**, Mann R, Fletcher J, Cuthill V, Clark SK, von Roon AC, Latchford A. (2023) Long-term outcomes of pouch surveillance and risk of neoplasia in familial adenomatous polyposis. **Endoscopy** 55(09): 836-846 [†]joint first authors

25. Ghosh P, Campos VJ, Vo DT, Guccione C, Goheen-Holland V, Tindle C, Mazzini GS, He Y, Alexandrov LB, Lippman SM, Gurski RR, Das S, Yadlapati R, **Curtius K***, Sahoo D. (2022) AI-assisted discovery of an ethnicity-influenced driver of cell transformation in esophageal and gastroesophageal junction adenocarcinomas. **JCI Insight** 7(18):e161334

24. Ma SD, Guccione C, Linnemeyer K, Weissbrod PA, **Curtius K**, Yadlapati RH. (2022) Oral Microbiome Diversity Between Patients with Normal vs Elevated Salivary Pepsin Levels and its Implication in Gastroesophageal Reflux Disease. **Foregut** 3(1):131-134

23. Guo Q, Lakatos E, Al Bakir I, **Curtius K**, Graham TA, Mustonen V. (2022) The mutational signatures of formalin fixation on the human genome. **Nat Commun** 13:4487.

22. **Curtius K*[†]**, Kabir M[†], Al Bakir I, Choi CHR, Hartono J, Johnson M, East JEE, Lindsay JO, Vega R, Thomas-Gibson S, Wilson A, Graham TA, Hart A. (2022) Multi-centre derivation and validation of a colitis-associated colorectal cancer risk prediction web-tool. **Gut** 71(4):705-715. [†]joint first authors

- Blog in **Gut** "#GUT Blog: Multicentre derivation and validation of a colitis-associated colorectal cancer risk prediction web tool", Phil Smith
  https://blogs.bmj.com/gut/2022/03/11/ *Mar 2022*

21. Sepich-Poore GD†, Guccione C†, Laplace L, Pradeu T, **Curtius K**, Knight R. (2022) Cancer's second genome: Microbial cancer diagnostics and redefining clonal evolution as a multispecies process. **BioEssays** e2100252.†joint first authors

20. **Curtius K**, Gupta S, Boland CR. (2022) Lynch Syndrome- a mechanistic and clinical practice update. **Aliment Pharmacol Ther** 55:960–977.

19. Guccione C, Yadlapati R, Shah S, Knight R, **Curtius K***. (2021) Challenges in determining the role of microbiome evolution in Barrett's esophagus and progression to esophageal adenocarcinoma. **Microorganisms** 9(1):2003

18. **Curtius K***, Rubenstein JH, Chak A, Inadomi JM. (2021) Computational modelling suggests that Barrett's oesophagus may be the precursor of all oesophageal adenocarcinomas. **Gut** 70(8):1435-1440

    - Commentary in **Gut** "Screening for Barrett's oesophagus: are we looking for the right thing?" Spechler SJ 2021;70:1426–1427.

17. Luebeck GE, Vaughan TL, **Curtius K**, Hazelton WD. (2021) Modeling historic incidence trends implies early field cancerization in esophageal squamous cell carcinoma. PLoS Comput Biol 17(5):e1008961

16. **Curtius K***, Dewanji A, Hazelton WD, Rubenstein JH, Luebeck GE. (2021) Optimal timing for cancer screening and adaptive surveillance using mathematical modeling. **Cancer Res** 81(4):1123-1134

15. Tamura N, Shaikh N, Muliaditan D, McGuinness J, Moralli D, Durin MA, Green CM, Bowtell D, Balkwill FR, **Curtius K**, McClelland SE. (2020) Mechanisms of Chromosomal Instability in High-grade Serous Ovarian Carcinoma. **Cancer Res** 80(22):4946-4959

14. Saunderson EA, Baker AM, Williams M, **Curtius K**, Jones JL, Graham TA, Ficz G. (2020) A novel method of single strand library preparation for whole genome sequencing of formalin-fixed paraffin-embedded tissue samples. **NAR Genom Bioinform** 2(1):lqz017

13. Baker AM†, Cross WC†, **Curtius K†**, Al Bakir I†, Choi CHR†, Davis HL, Temko D, Biswas S, Martinez P, Williams MJ, Lindsay JO, Feakins R, Vega R, Hayes S, Tomlinson IPM, McDonald SAC, Moorghen M, Silver A, East JE, Wright NA, Wang LM, Rodriguez-Justo M, Jansen M, Hart AL, Leedham SJ, Graham TA. (2019) The evolutionary history of human colitis-associated colorectal cancer. **Gut** 68(6):985-995 †joint first authors

12. Rockne R, Hawkins-Daarud A, Swanson K, Sluka J, Glazier J, Macklin P, Hormuth II DA, Jarrett AM, Lima EABF, Oden JT, Biros G, Yankeelov TE, **Curtius K**, Al-Bakir I, Wodarz D, Komarova N, Aparicio L, Bordyuh M, Rabadan R, Finley SD, Enderling H, Caudell J, Moros EG, Anderson ARA, Gatenby RA, Kaznatcheev A, Jeavons P, Krishnan N, Pelesko J, Wadhwa RR, Yoon N, Nichol D, Marusyk A, Hinczewski M, Scott JG. (2019) The 2019 Mathematical Oncology Roadmap. **Phys Biol** 16:041005

11. Luebeck EG, Hazelton WD, **Curtius K**, Maden S, Yu M, Carter KT, Burke W, Lampe PD, Li CI, Ulrich CM, Newcomb PA, Westerhoff M, Kaz AM, Luo Yanxin, Inadomi JM, Grady WM. (2019) Implications of Epigenetic Drift in Colorectal Neoplasia. **Cancer Res** 79(3):495-504

    - Highlights article in **Cancer Res** "Epigenetic Drift in Colorectal Cancer – It's Probably Later Thank You Think". Sapienza C 79(3):437-438
    - Fred Hutch Science Spotlight Article "The slow journey of a premalignant cell"
      https://www.fredhutch.org/en/news/spotlight/2018 *Dec 2018*

10. Al Bakir I, **Curtius K**, Graham TA. (2018) From Colitis to Cancer: An Evolutionary Trajectory That Merges Maths and Biology. Front Immunol 9:2368

9. **Curtius K**, Wright NA, Graham TA. (2018) An evolutionary perspective on field cancerization. Nat Rev Cancer 18:19-32

8. Luebeck EG, **Curtius K***, Hazelton WD, Maden SK, Yu M, Thota PN, Patil DT, Chak A, Willis JE, Grady WM. (2017) Identification of a key role of widespread epigenetic drift in Barrett's esophagus and esophageal adenocarcinoma. **J Clin Epigenet** 9(113):1-10

7. Kroep S†, Heberle C†, **Curtius K†**, Lansdorp-Vogelaar I, Hazelton WD, van Ballegooijen M, Tramontano AC, Gazelle GS, Luebeck EG, Inadomi JM, Hur C. (2017) Radiofrequency Ablation of Barrett's Esophagus Reduces Esophageal Adenocarcinoma Incidence and Mortality in a Comparative Modeling Analysis. **Clin Gastroenterol Hepatol** 15(9):1471-1474 †joint first authors

6. **Curtius K***, Wong C, Hazelton WD, Kaz AM, Chak A, Willis JE, Grady WM, Luebeck EG. (2016) A Molecular Clock Infers Heterogeneous Tissue Age Among Patients with Barrett's Esophagus. PLoS Comput Biol 12(5):e1004919

5. Hazelton WD, **Curtius K**, Inadomi JM, Vaughn TL, Meza R, Rubenstein JH, Hur C, Luebeck G. (2015) The role of gastroesophageal reflux and other factors during progression to esophageal adenocarcinoma. **Cancer Epidemiol Biomarkers Prev** 24(7):1012-1023

4. **Curtius K***, Hazelton WD, Jeon J, Luebeck EG. (2015) A Multiscale Model Evaluates Screening for Neoplasia in Barrett's Esophagus. **PLoS Comput Biol** 11(5):e1004272

3. Kong CY, Kroep S, **Curtius K**, Hazelton WD, Jeon J, et al. (2014) Exploring the Recent Trend in Esophageal Adenocarcinoma Incidence and Mortality Using Comparative Simulation Modeling. **Cancer Epidemiol Biomarkers Prev** 23(6):997-1006

2. Luebeck EG, **Curtius K**, Jeon J, Hazelton WD. (2013) Impact of Tumor Progression on Cancer Incidence Curves. **Cancer Res** 73(3):1086-1096

Book Chapters

1. **Curtius K***, Wright NA, Graham TA. (2017) Evolution of Premalignant Disease, in *Cancer Evolution*, Swanton C, Bardelli A, Polyak K, Shah S, Graham TA, editors, Cold Spring Harbor Press.

Presentations (post PhD)

Invited Seminars

21. "Translational bioinformatics in IBD cancer risk assessment." Gastroenterology Research Seminar Series, Mayo Clinic, Rochester, MN *Scheduled for Nov 2025*

20. "Mathematical modeling of precancer evolution to improve cancer interception." Mathematical and Computational Modeling of Cancer Seminar Series (virtual) *Scheduled for Sept 2025*

19. "Predictive biomarkers of future colitis-associated colorectal cancer in IBD." UCSD Gastroenterology Grand Rounds, San Diego, CA *July 2023*

18. "Predicting future risk of colorectal cancer in patients with ulcerative colitis." Digestive Diseases Center seminar, University of Chicago, Chicago, IL (virtual) *Mar 2022*

17. "Predicting future risk of colorectal cancer in patients with ulcerative colitis." UCSD Biostatistics Quarterly Seminar (virtual) *Dec 2021*

16. "Copy number alterations predict colitis-associated colorectal cancer in patients with ulcerative colitis." CRUK Grand Challenge Key Concepts Meeting (virtual) *Oct 2021*

15. "Determining the age of Barrett's esophagus using stochastic multiscale modeling and epigenetic clocks." CRUK Cambridge Institute Quantitative Biology Seminar Series, Cambridge UK (virtual) *April 2021*

14. "Computational modeling of field cancerization to improve cancer control." UCSD Moores Cancer Center Structural and Functional Genomics Cross-lab Meeting, San Diego (virtual) *Dec 2020*

13. "Inference of field cancerization using stochastic models to improve cancer control." Computational Oncology Seminar Series, Memorial Sloan Kettering Cancer Center (virtual) *Dec 2020*

12. "Modeling field cancerization and tissue aging to improve screening and surveillance." Research Frontiers in Biomathematics Seminar Series, UCLA Department of Computational Medicine (virtual) *Nov 2020*

11. "Computational modeling of cancer evolution to optimize screening and surveillance." Integrative Mathematical Oncology Seminar, Moffitt Cancer Center, FL (virtual) *Sept 2020*

10. "Quantifying and communicating colitis-associated cancer risk to patients and clinicians." Inflammatory Bowel Disease City Wide Meeting, San Diego, CA (virtual) *Aug 2020*

9. "Catching cancer in the act: biologically-based models to optimize screening and surveillance." UC Riverside Interdisciplinary Center for Quantitative Modeling in Biology (virtual) *May 2020*

8. "How did that get there? Modelling tissue age evolution of Barrett's esophagus." Mathematical Biology and Ecology Seminar Series, Oxford Mathematical Institute, Oxford, UK *Feb 2019*

7. "Spatial evolution of Barrett's esophagus: insights from molecular clocks and mechanistic modelling." Life Sciences Initiative Centre for Computational Biology Workshop, Queen Mary University of London, London UK *Nov 2018*

6. "Optimal adaptive design for cancer screening and surveillance using multiscale modelling." Oslo Centre for Biostatistics and Epidemiology Seminar, University of Oslo, Norway *Feb 2018*

5. "Methylomic drift: a molecular clock for hidden biological aging." Program for Evolutionary Dynamics Seminar, Harvard University, Cambridge, MA *May 2016*

4. "Beyond Chronological Age: using Bayesian Inference for hidden biological aging." Spring Speaker Series 2016, Nathan Schock Center of Excellence in the Basic Biology of Aging, UW Healthy Aging and Longevity (HALo) Research Institute, Seattle, WA *April 2016*

3. "Bayesian inference of Barrett's esophagus tissue age using a molecular clock." Stochastic Modeling Group meeting, UW Department of Statistics, Seattle, WA *April 2016*

2. "Beyond Chronological Age: using Bayesian Inference for hidden biological aging." Data Science Affinity Group Seminar, Fred Hutchinson Cancer Research Center, Seattle, WA *Mar 2016*

1. "Biological vs. Chronological Aging: a biomathematical study of Barrett's esophagus." Research Information Management Seminar, Department of Information Sciences, Beckman Research Institute, City of Hope, Duarte, CA *Feb 2016*

Conference Presentations

38. Invited Plenary Talk: "Mathematical modeling of cancer evolution to optimize early detection." Society for Mathematical Biology Annual Meeting, Edmonton, Canada *Scheduled for July 2025*

37. Invited Speaker, Panel Discussion: "Defining the Pre-Cancer State to Enable Innovations in Early Identification and Preventive Intervention." Cancer Prevention Research Conference 2025, London, UK: *Scheduled for June 2025*

36. Talk: "Genomic biomarker from shallow whole genome sequencing predicts future high-grade dysplasia and colorectal cancer in ulcerative colitis." Digestive Disease Week, San Diego, CA *May 2025*

35. Invited Keynote Talk: "Detecting cancer earlier: translational bioinformatics and math modeling approaches." Annual Bioinformatics Exchange (BEx), UCSD, La Jolla, CA *March 2025*

34. Talk (invited): "Estimating clonal dynamics using coalescent theory and branching processes." Fields Institute workshop, Toronto, Ontario, Canada. *Oct 2024*

33. Minisymposium Talk (invited): "Multiscale models of cancer and microbial evolution to inform prevention strategies in esophageal adenocarcinoma." Joint Korean Society for Mathematical Biology / Society for Mathematical Biology Annual Meeting, Seoul, Republic of Korea. *July 2024*

32. Talk (invited):"Genomic evolution and biomarkers in IBD carcinogenesis." Moores Cancer Center Structural and Functional Genomics Annual Retreat, San Diego, CA *May 2023*

31. Talk (invited): "Mathematical models for GI cancer screening and surveillance." Digestive Disease Week, Washington D.C. *May 2024*

30. Major Symposium Talk (invited): "Stochastic modeling of clonal evolution in carcinogenesis." American Association of Cancer Research (AACR) Annual Meeting, USC, Los Angeles, CA. *April 2024*

29. Talk (invited): "Translating biomarkers from shallow whole genome sequencing that predict future cancer in patients." Office of Translational Science Retreat Sparkathon, La Jolla, CA. *Feb 2024*

28. Talk (invited): "Aging Markers and Early-age Onset Colorectal Cancer." Fight CRC Early Age Onset Colorectal Cancer Think Tank, Nashville TN. *Dec 2023*

27. Talk (invited): "Measuring single cell clonal dynamics in human blood using coalescent point processes." UCSD CBIO Retreat, San Diego, CA *July 2023*

26. Talk (invited): "Forecasting Cancer Evolution." Moores Cancer Center Board meeting, San Diego, CA *June 2023*

25. Talk (invited): "Genomic evolution and biomarkers in IBD carcinogenesis." Structural and Functional Genomics Annual Retreat, Moores Cancer Center, UCSD. *May 2023*

24. Talk (invited): "Measuring single cell clonal dynamics in human blood using coalescent point processes." SoCal Systems Biology Conference, USC, Los Angeles, CA. *April 2023*

23. Talk (invited): "Genomic evolution and biomarkers in IBD carcinogenesis." California Digestive Diseases Research Core Center Network Symposium (virtual) *Dec 2022*

22. Session Talk: "Quantitative Cancer Control as a strategy for assessing and managing GI cancer risk." Digestive Disease Week, San Diego, CA *May 2022*

21. Talk (invited): "Molecular biomarkers for colitis-associated colorectal cancer in patients with inflammatory bowel disease." San Diego Digestive Diseases Research Center Annual Symposium *Feb 2022*

20. Talk (invited): "Tracking genomic biomarkers of pre-cancer evolution." UCSD Moores Cancer Center: Cancer Control Program Annual Retreat, San Diego (virtual) *Sept 2021*

19. Minisymposium Talk (invited): "Predicting Risk of Progression to Advanced Neoplasia in Patients with Ulcerative Colitis" in Mathematical approaches to advance clinical studies in oncology minisymposium. Society for Mathematical Biology Annual Meeting, UC Riverside (virtual) *June 2021*

18. Talk (invited): "Quantifying copy number evolution to predict colitis-associated cancer risk." Moores Cancer Center Annual Retreat, UCSD Moores Cancer Center, San Diego, CA (virtual) *Oct 2020*

17. Poster of Distinction: "Multi-centre validation of risk stratification for colitis patients with low grade dysplasia using UC-CaRE: a predictive clinical decision support tool." Digestive Disease Week, Chicago, IL (virtual) *May 2020*

16. Talk: "Understanding and communicating colitis cancer risk to patients and clinicians." European Union - Colitis cAncer Risk Estimation consortium (EU-CaRE), Vienna, Austria *Feb 2020*

15. Talk: "Shallow whole genome sequencing predicts future colorectal cancer risk in ulcerative colitis." New Horizons in Genomics conference, London, UK *July 2019*

14. Talk (invited): "Optimal adaptive design for cancer screening using mathematical modeling: a case study in Barrett's esophagus." Cancer Intervention and Surveillance Modeling Network (CISNET) Mid-year Meeting, Seattle, WA *May 2019*

13. Distinguished Abstract Plenary Talk: "Quantifying evolution of early dysplastic lesions in ulcerative colitis predicts future colorectal cancer risk." Digestive Disease Week, San Diego, CA *May 2019*

12. Future Leaders Proferred Talk: "Single Cell Clonal Diversity Predicts Progression to Esophageal Adenocarcinoma in Patients with High Risk Barrett's Esophagus." International Symposium on Oesophageal Cancer 2019, London, UK *May 2019*

11. Talk: "Spatial evolution of Barrett's esophagus: insights from molecular clocks and mechanistic modelling." BIRS-CMO Workshop: Mathematical challenges in the analysis of continuum models of cancer growth, evolution and treatment, Casa Matematica Oaxaca, Oaxaca, MX *Nov 2018*

10. Poster: "Quantifying evolution of early dysplastic lesions in ulcerative colitis predicts future colorectal cancer risk." Early Detection of Cancer, Oregon Health Sciences University, Portland, OR *Oct 2018*

9. Minisymposium Talk (invited): "Optimal cancer screening regimes in gastrointestinal evolution using mathematical modelling" in Data-driven mechanistic cancer models minisymposium. Joint Japanese Society for Mathematical Biology/ Society for Mathematical Biology Annual Meeting, University of Sydney, Australia *July 2018*

8. Talk: "Optimal adaptive design for Barrett's esophagus screening and surveillance using multiscale modelling." UK Conference on Multiscale Biology, University of Nottingham, UK *April 2018*

7. Talk (invited): "Mapping phenotype and genotype during colitis-associated neoplastic progression." Centre for Computational Biology Networking Day, Queen Mary University of London, UK *July 2017*

6. Future Leaders Proferred Talk: "Widespread Epigenetic Drift in Barrett's Esophagus: molecular clock and evolutionary force." Cancer Research UK International Symposium on Oesophageal Cancer, Cambridge, UK *April 2017*

5. Talk: "Tissue Ageing and Cancer Risk: lessons from the methylome." Society for Experimental Biology Cell Symposium, Oxford, UK *Sept 2016*

4. Poster: "Beyond Chronological Age: methylomic drift and biological aging in intestinal metaplasia." James W. Freston Conference 2016, Chicago, IL *Aug 2016*

3. Talk: "Bayesian inference of Barrett's esophagus tissue age using a molecular clock." Joint European Society for Mathematical and Theoretical Biology / Society for Mathematical Biology Meeting 2016, Nottingham, UK *July 2016*

2. Talk: "Methylomic Drift in EAC Progression." Multiscale Modeling Mid-year Meeting, Massachusetts General Hospital, Boston, MA *May 2016*

1. Talk: "Barrett's Esophagus Dwell Time: a new candidate biomarker." CISNET Annual Meeting, National Cancer Institute, Rockville, MD *Nov 2015*

Professional Societies and Groups

- San Diego Digestive Diseases Research Center (SDDRC) Member *2021 –Present*
- American Association for Cancer Research (AACR) Member *2019 – Present*
- American Gastroenterology Association (AGA) Member *2018 – Present*
- Society for Mathematical Biology (SMB) Member *2010 – Present*
- QMUL Life Sciences Initiative Centre for Computational Biology (CCB) Member *2018 – 2020*
- NCI CISNET Esophagus Group Member *2011 – 2016*

Professional Activities and Leadership

Conference Committees/Organizer

11. Session organizer/moderator: World Endoscopy Organization Colorectal Cancer Screening Committee Plenary Meeting 2025, San Diego, CA *May 2025*
10. Chair-Elect Nominating Committee member: AACR Cancer Evolution Working Group (CEWG) *2025*
9. Organizing committee member: "Evolutionary Biology and Ecology of Cancer." Wellcome Connecting Science Courses, Hinxton, UK *June 2025, June 2022*
8. Course co-organizer: "Dynamics and Statistics of Cancer Evolution Research School." Centre International de Rencontres Mathematiques (CIRM), Marseille, FR *June 2022*
7. Session organizer/moderator: Digestive Disease Week 2022, San Diego, CA *May 2022*
6. Organizing committee member: UCSD Moores Cancer Center: Cancer Control program retreat 2021. (virtual) *Sept 2021*
5. Program committee member: International Symposium on Mathematical and Computational Oncology. (virtual) *Oct 2020, 2021*
4. Symposium co-organizer : "Models of Cancer Evolution and Ecology." Mathematical Models in Ecology and Evolution (MMEE), Lyon, France *July 2019*
3. Conference co-organizer: "New Horizons in Genomics." QMUL, London, UK *1 - 5 July, 2019*
2. Minisymposium co-organizer: "Forecasting cancer evolution I & II: combining mathematical modelling and experimental/clinical data." MMEE, London, UK *July 2017*
1. Minisymposium organizer: "Barrett's Esophagus: biology, etiology, and cancer risk." European Conference for Mathematical and Theoretical Biology (ECMTB), Nottingham, UK *July 2016*

Invited Journal Referee

- Journal of the American Medical Association (JAMA)*, Nature*, Nature Genetics*, Nature Communications*, Gastroenterology*, Cancer Research*, American Journal of Gastroenterology*, Nature Reviews Cancer*, Clinical Gastroenterology and Hepatology*, Risk Analysis, PLoS Computational Biology, Evolutionary Applications, Cancer Epidemiology Biomarkers and Prevention, Annals of the New York Academy of Sciences, European Biophysics Journal.
  * denotes reviews performed since 2020

Invited Grant Referee

- AGA Fellowship-to-Faculty Transition Award Grant Reviewer *Nov 2024*
- Veteran Affairs Oncology-C Subcommittee Grant Reviewer *Nov 2023*
- SDDRC Pilot and Feasibility Grant Reviewer *Nov 2023, Jan 2025*
- Health Research Board Ireland Grant Reviewer *Nov 2023*
- Dutch Cancer Society Grant Reviewer *Jan 2023*
- Veteran Affairs Special Emphasis Panel Grant Reviewer *June 2021*
- Moores Cancer Center/Padres Pedal the Cause Team Science Award Grant Reviewer *Dec 2020*
- UCSD KL2 Training Awards Grant Reviewer *Fall 2020*
- CRUK City of London Center Development Fund Awards Reviewer *March 2019*

Invited Conference Abstract Referee

- AGA Digestive Disease Week (DDW) Abstract Reviewer *2022, 2023*
- American Association of Cancer Research (AACR) Annual Meeting Abstract Reviewer *2023*

University Leadership

- Member, UCSD Professional Schools IT committee *2024 – Present*
- Liaison, Moores Cancer Control Program, Office of Translational Science committee *2023 – Present*
- Member, UCSD Bioinformatics and Systems Biology PhD Steering committee *April 2022 – Present*
- Member, DBMI Representative, UCSD Health Sciences EDI Ambassadors *Nov 2021– Present*
- Member, UCSD Bioinformatics and Systems Biology Admissions committee *July 2020 – July 2024*
- Member, UCSD Bioinformatics Diversity, Equity, and Inclusion committee *July 2020 – Dec 2022*
- Member, QMUL Institute of Applied Data Science Colloquia organizing committee *2018 – May 2020*
- Lab meeting leader: Evolution and Cancer Laboratory, Barts Cancer Institute *Oct 2016 – Feb 2018*
- Journal club leader: UW Mathematical Biology Journal Club *Sept 2011 – Winter 2014*
- Treasurer: SIAM Student Chapter, University of Washington *Sept 2010 – 2014*

Professional Development

- Participant, UCSD Building a Respectful and Inclusive Culture Course *2024*
- Participant, NFCCD Faculty Success Program program *2023*
- Participant, UCSD National Center of Leadership in Academic Medicine (NCLAM) program *2021*

Mentoring

Postdoctoral and Clinical Fellows Supervised

- Anna Dornisch, UCSD Department of Radiation Medicine & Applied Sciences Resident
  QCC lab member (Feb 2024 – Present)
  Project: *"Cost-effectiveness of surveillance strategies to intercept colitis-associated colorectal cancer"*

PhD Students Supervised

- Samuel Reynolds: UCSD Bioinformatics and Systems Biology PhD student
  QCC lab member (Sept 2024 – Present)
  Project: *"Spatiotemporal evolution in Barrett's esophagus"*
  - T15 Biomedical Informatics predoctoral fellow

- Hyrum Eddington: UCSD Bioinformatics and Systems Biology PhD student
  QCC lab member (co-advised with Dr. Hannah Carter, Sept 2024 – Present)
  Research rotation, Biomedical Informatics
  Project: *"Copy Number Alterations in Low Grade Dysplasias in Patients with Inflammatory Bowel Disease: An Exploratory Analysis using Low-pass Sequencing Data"* *Fall 2023*
  - T15 Biomedical Informatics predoctoral fellow
  - Student awarded 2025 NSF Graduate Research Fellowship *2025*

- Brian Johnson: UCSD Bioinformatics and Systems Biology PhD student
  QCC lab member (Sept 2022 – Present)
  Research rotation, Biomedical Informatics
  Project: *"Neutral tumor evolution to date genetic clones"* *Fall 2021, Spring 2022*
  - T15 Biomedical Informatics predoctoral fellow

- Caitlin Guccione: Bioinformatics and Systems Biology PhD student, UCSD (defended PhD Mar 2025)
  QCC lab member (co-advised with Dr. Rob Knight, Sept 2021 – Winter 2025)
  Thesis title: *"Disentangling the cancer microbiome: overcoming host contamination to model population dynamics and advance diagnostics"*

Master's Students Supervised

- Mengxue Xia: UCSD Biostatistics Master's research student
  QCC lab member (June 2024 – Present)
  Project title: *"Inflammatory bowel disease and gastric intestinal metaplasia mutational signatures, copy number alterations, and cancer risk"*

Undergraduate Students Supervised

- Nicole Jin, UCSD Biology with Bioinformatics Minor undergraduate student
  QCC lab member (Mar 2025 – Present)
  Project: *"Case-Control for Colitis Cancer from Low-grade dysplasia in North America study"*

- Lana Chuang, UCSD Biology with Bioinformatics Minor undergraduate student
  QCC lab member (Feb 2024 – Present)
  Project: *"Case-Control for Colitis Cancer from Low-grade dysplasia in North America study"*

- Erica Rodas Montejo: DBMI Summer Intern/Summer Training Academy for Research Success (STARS) Program student in QCC lab
  Project: *"Teasing apart the microbiome in pre-cancerous conditions of the colon"* *Summer 2024*

- Lorijane Robles, UCSD Human Biology undergraduate student
  QCC lab member (July 2023 - June 2024)
  Project: *"Biomarkers in gastric intestinal metaplasia and patients with H. pylori"*
  - Student co-advised with Drs. Yadlapati and Shah as part of the GEODE research program.

- Sandrine Amudhan: Molecular & Cell Biology undergraduate student
  QCC lab member (Dec 2022 - June 2024)
  Project: *"Developing biomarkers of colorectal cancer risk in North American patients with inflammatory bowel disease using shallow whole genome sequencing"*

- Samantha Ryan: DBMI Summer Intern in QCC lab
  Project: *"Inflammatory Bowel Disease and Microbial Precursors to Cancer"* *Summer 2022*

- Phillip Pham: DBMI Summer Intern/ STARS Program student in QCC lab
  Project: *"Determining whole genome doubling in low-pass sequencing of ulcerative colitis"*
  - Student awarded Fullbright Scholarship (current position) *Summer 2021*

- McKenna Lewis: UCSD Computer Science undergraduate student
  QCC lab member (Sept 2020 – Sept 2022)
  CSE 199: *"Building molecular clocks in gastrointestinal precancers"* *Fall 2020*
  - UCSD URS Chancellor's Research Scholarship for Science and Engineering Award *Summer 2021*
  - Student received NSF Graduate Research Fellowship Honorable Mention *2022*
  - Current position: Software Engineer at Resilience

  Barts Cancer Institute:

- Daniel Muliaditan: MSc Cancer & Molecular and Cellular Biology, Barts and The London
  Thesis: *"Exploring copy-number alterations in colitis-associated carcinogenesis"* *Summer 2018*
  - Barts and the London Principal's Prize for academic excellence
  - Drapers' Company Postgraduate Prize
  - PhD in Biomedical Engineering at A*star Genome Institute of Singapore
  - Current position: postdoc at Genome Institute of Singapore

- Kristiana Grigoriadis: Oxford undergraduate math summer student, Barts and The London
  Project: *"Mathematical modelling of the development of Barrett's esophagus"* *Summer 2017*
  - Wellcome Trust Biomedical Vacation Scholarship
  - E J Ball Research Scholarship
  - PhD in Charles Swanton lab at the Francis Crick Institute, London, UK
  - Current position: Genomics analyst at GSK, Oncology Department.

High School Student Supervised

- Busra Coskun: Summer NIDDK Short-Term Research Experience Program to Unlock Potential (STEP-UP) researcher in QCC lab
  Project: *"Somatic and germline mutations in Inflammatory Bowel Disease"* *Summer 2023*

PhD Thesis Committees

- Member, UCSD BISB Thesis Committee (PhD student James Talwar): Senate exam March 2022, Thesis defense Dec 2024
- Member, UCSD BISB Thesis Committee (PhD student Azhar Khandekar): Senate exam March 2022
- Member, UCSD BISB Thesis Committee (PhD student Gibraan Rahman): Senate exam March 2022, Thesis defense June 2023
- Member, UCSD Mathematics Thesis Committee (PhD student Yubo Shuai): Candidacy exam Nov 2022
- Member, UCSD BISB Thesis Committee (PhD student Mariya Kazachkova): Senate exam June 2023
- Member, UCSD Biomedical Sciences (BMS) Thesis Committee (PhD student Mengzhou Hu): Candidacy exam May 2024
- Member, UCSD BISB Thesis Committee (PhD student Gege Qian): Senate exam June 2024
- Member, UCSD BISB Thesis Committee (PhD student Jessica Au): Senate exam June 2024
- Member, UCSD BioSci Thesis Committee (PhD student Andrew Tong): Senate exam June 2024
- Member, UCSD CSE Thesis Committee (PhD student Bhargavi Dameracharla): Senate exam Mar 2025

Teaching & Course Design

- Course Director/Instructor: MED 263 "Bioinformatics Applications to Human Disease", UCSD
  Winter 2022, Winter 2024, Winter 2025
  I design this graduate level course consisting of weekly modules arranged by various bioinformatics topics that include lectures paired with hands-on practical sessions so that students learn how to write computer code to analyze a range of multi-omics data types by the time the course is finished (4 units).

- Co-instructor: MED 278 "Cancer Genomics Journal Club", UCSD
  Fall 2021 – Winter 2025
  With Drs. Hannah Carter and Jill Mesirov, I co-instruct and organize this graduate level course consisting of weekly journal club presentations by students on current cancer genomics topics. Each student learns how to effectively present published results and facilitate scientific discussions (1 unit).

- Course guest moderator: BIOM 272 Seminars in Genetics, UCSD *Spring 2023*

- Course lecturer: " 'Omics with an evolutionary perspective", UCSD
  - DBMI Summer Internship Program *Summer 2021, Summer 2022*

- Course lecturer: "Prediction Modeling and Clinical Decision Support", UCSD
  - CLRE 266: Comparative Effectiveness Research *Spring 2021, Spring 2022, Spring 2023*

- Guest Faculty reviewer, topic: "Cancer genomics and genetics", UCSD
  - MED 276: Grant Writing Course *Spring 2021*

- Course lecturer: "Cancer Genomics and Evolution", UCSD
  - MED 264: Principles of Biomedical Informatics *Fall 2020, Fall 2021, Fall 2023*

- Course lecturer: "Multistage models of cancer: making evolutionary sense of epidemiological data"
  Centre International de Rencontres Mathematiques (CIRM), Marseille, FR *June 2022*

United Kingdom:

- Tutor (UK Instructor), Barts and The London School of Medicine and Dentistry, London:
  - Problem-Based Learning: Human Science and Public Health Module *Spring 2019, Spring 2020*

- MRes course lecturer: "Cancer Modelling", King's College London:
  - Molecular pathology of cancer, application in cancer diagnosis, screening and treatment *Jan 2019*

- Invited Tutor, Evolutionary Biology and Ecology of Cancer Advanced Course,
  Wellcome Genome Campus Conference Centre, Hinxton, Cambridge, UK:
  - "Evolutionary prognostics: Introduction to Multistage Models" *Summer 2018*

- Tutor, Barts and The London School of Medicine and Dentistry, London:
  - Problem-Based Learning: Human Science and Public Health Module *Spring 2017, Spring 2018*

- MRes course lecture: "Math in cancer research", King's College London:
  - Molecular pathology of cancer, application in cancer diagnosis, screening and treatment *Nov 2017*

University of Washington:

- Teaching Assistant, University of Washington, Seattle:
  - MATH 125: Calculus with Analytic Geometry II *Fall 2010*

UCLA:

- Academics in the Commons, Math/Science Tutor, University of California, Los Angeles:
  -MATH 31A: Differential & Integral Calculus *Fall 2008*
  -MATH 31B: Integration & Infinite Series *Winter 2009*