March 14, 2025

Curriculum vitae

PERSONAL INFORMATION

Name: Jeremy E. Purvis, Ph.D.

Address: Computational Medicine Program
11018C Mary Ellen Jones Building
116 Manning Drive
Chapel Hill, NC 27599-7488

Phone: (919) 962-4923

E-mail address: jeremy_purvis@med.unc.edu

EDUCATION

2009 – 2013 Harvard Medical School — Boston, MA
Postdoctoral Research Fellow
Mentor: Prof. Galit Lahav, Department of Systems Biology
Focus: *Transcriptional dynamics and cellular function of p53 pulses*

2005 – 2009 University of Pennsylvania — Philadelphia, PA
Ph.D., Genomics and Computational Biology
Mentors: Prof. Scott L. Diamond, Department of Chemical and Biomolecular Engineering and Prof. Ravi Radhakrishnan, Department of Bioengineering
Dissertation: *A systems approach to cellular signal transduction*

2002 – 2004 University of Florida — Gainesville, FL
M.S., Microbiology and Cell Science
Mentor: Prof. Lonnie O. Ingram, Department of Microbiology and Cell Science
Thesis: *Enhanced trehalose production in* Escherichia coli

1997 – 2002 University of Florida — Gainesville, FL
B.S., Microbiology and Cell Science

PROFESSIONAL AND LEADERSHIP APPOINTMENTS

2024 – Associate Chair for Education, Department of Genetics
University of North Carolina at Chapel Hill — Chapel Hill, NC

2024 – Professor, Department of Genetics
University of North Carolina at Chapel Hill — Chapel Hill, NC

2024 – Director, Amgen Scholars Program
University of North Carolina at Chapel Hill — Chapel Hill, NC

2019 – 2024	Associate Professor, Department of Genetics University of North Carolina at Chapel Hill	Chapel Hill, NC
2018 –	Core Faculty Member, Computational Medicine Program University of North Carolina at Chapel Hill	Chapel Hill, NC
2018 – 2023	Adjunct Professor, Department of Biomedical Engineering University of North Carolina at Chapel Hill	Chapel Hill, NC
2013 –	Core Faculty Member, Curriculum in Bioinformatics and Computational Biology University of North Carolina at Chapel Hill	Chapel Hill, NC
2013 –	Member, Lineberger Comprehensive Cancer Center University of North Carolina at Chapel Hill	Chapel Hill, NC
2013 – 2019	Assistant Professor, Department of Genetics University of North Carolina at Chapel Hill	Chapel Hill, NC

Other Professional Experience

2004 – 2005	Manatee County School Board Mathematics Teacher	Bradenton, FL

HONORS AND AWARDS

2024	Academic Leadership Fellow, Institute for the Arts and Humanities
2023	Leading Transformation in Academic Medicine, Inaugural Cohort
2019	Visiting Scholar Appointment in Chemical and Biomolecular Engineering University of Pennsylvania
2018	National Science Foundation CAREER Award
2016	NIH Director's New Innovator Award
2015	W. M. Keck Foundation Medical Research Award
2014	UNC Junior Faculty Development Award
2012	NIH Pathway to Independence Award - NIGMS (K99/R00)
2010	Ruth L. Kirschstein National Research Service Award - NIGMS (F32)
2011	Visiting Scholar at Duke Center for Systems Biology
2008	Computational Genomics Training Grant Awardee – NHGRI (T32)
2008	Computational Molecular Science and Engineering Forum Graduate Student Award

2004 James Davidson Graduate Travel Scholarship

2004 American Society for Microbiology Travel Award

2003 President's Award, American Society for Microbiology

1997 Robert C. Byrd Honors Scholarship

1997 University of Florida Honors Program

BIBLIOGRAPHY

Book Chapter

- **Purvis JE**, Shih AJ, Liu Y, Radhakrishnan R. Cancer Cell: Linking Oncogenic Signaling to Molecular Structure. (2011) in *Multi-Scale Cancer Modeling*, ed. Deisboeck T. (Chapman & Hall). pp 31-43. PMID: 25285322

Refereed Original Research Articles

- Luo H, **Purvis JE**, Li D. Spherical Rotation Dimension Reduction with Geometric Loss Functions. (2024) arXiv preprint. Accepted at the *Journal of Machine Learning Research* (6/10/2024).
- Ranek JS, Stallaert W, Milner J, Stanley N, **Purvis JE**. Feature selection for preserving biological trajectories in single-cell data. (2024) *Nature Communications* 15(1):2765.
- Zikry TM, Wolff SC, Ranek JS, Davis H, Naugle A, Whitman AA, Kosorok MR, Spanheimer PM, **Purvis JE**. Cell cycle plasticity underlies fractional resistance to palbociclib in ER+/HER2- breast tumor cells. (2024) *Proceedings of the National Academy of Sciences USA*. 121(7):e2309261121.
- Shahir JA, Stanley N, **Purvis JE**. Cellograph: A Semi-supervised Approach to Analyzing Multi-condition Single-cell RNA-sequencing Data Using Graph Neural Networks. (2024) *BMC Bioinformatics*. 25(1):25.
- Cho M, Kumar RJ, Lin C, Boyer JA, Shahir JA, Fagan-Solis K, Simpson DA, Fan C, Foster CE, Goddard AM, Wang Q, Wang Y, Ho AY, Liu P, Perou CM, Zhang Q, McGinty RK, **Purvis JE**, Gupta GP. Mre11 liberates cGAS from nucleosome sequestration during tumorigenesis. (2024) *Nature*. 2024 Jan;625(7995):585-592. doi: 10.1038/s41586-023-06889-6.
- Adler FR, Anderson ARA, Bhushan A, Bogdan P, Bravo-Cordero JJ, Brock A, Chen Y, Cukierman E, DelGiorno KE, Denis GV, Ferrall-Fairbanks MC, Gartner ZJ, Germain RN, Gordon DM, Hunter G, Jolly MK, Karacosta LG, Mythreye K, Katira P, Kulkarni RP, Kutys ML, Lander AD, Laughney AM, Levine H, Lou E, Lowenstein PR, Masters KS, Pe'er D, Peyton SR, Platt MO, **Purvis JE**, Quon G, Richer JK, Riddle NC, Rodriguez A, Snyder JC, Szeto GL, Tomlin CJ, Yanai I, Zervantonakis IK, Dueck H. Modeling collective cell behavior in cancer: perspectives from an interdisciplinary conversation (2023) *Cell Systems* 14(4):252-257. PMID: 37080161
- Stallaert W, Taylor SR, Kedziora KM, Johnson MS, Taylor CD, Sobon HK, Young CL, Limas JC, Varblow-Holloway J, Cook JG, **Purvis JE**. The molecular architecture of cell cycle arrest (2022). *Molecular Systems Biology* 18(9):e11087. PMID: 36161508
- Ranek JS, Stanley N, **Purvis JE**. Integrating temporal single-cell gene expression modalities for trajectory inference and disease prediction (2022). *Genome Biology* 23(1):186. PMID: 36064614

- Mei L, Kedziora KM, Song EA, **Purvis JE**, Cook JG. The consequences of differential origin licensing dynamics in distinct chromatin environments. (2022) *Nucleic Acids Research* Jan 26:gkac003. PMID: 35079814
- Burclaff J, Bliton RJ, Breau KA, Ok MT, Gomez-Martinez I, Ranek JS, Bhatt AP, **Purvis JE**, Woosley JT, Magness ST. A proximal-to-distal survey of healthy adult human small intestine and colon epithelium by single-cell transcriptomics. *Cellular and Molecular Gastroenterology and Hepatology*. (2022) 13(5):1554-1589. PMID: 35176508
- Stallaert W, Kedziora KM, Taylor CD, Zikry TM, Ranek JS, Sobon HK, Taylor SR, Young CL, Cook JG, **Purvis JE**. The structure of the human cell cycle. (2021) *Cell Systems* 13(3):230-240. PMID: 34800361
- Enrico TP, Stallaert W, Wick ET, Ngoi P, Wang X, Rubin SM, Brown NG, **Purvis JE**, Emanuele MJ. Cyclin F drives proliferation through SCF-dependent degradation of the retinoblastoma-like tumor suppressor p130/RBL2. *Elife*. 2021 Dec 1;10:e70691. PMID: 34851822
- Haggerty RA, **Purvis JE**. Inferring the structures of signaling motifs from paired dynamic traces of single cells. (2021) *PLoS Computational Biology* 17(2):e1008657. PMID: 33539338
- Kumar RJ, Chao HX, Simpson DA, Feng W, Cho MG, Roberts VR, Sullivan AR, Shah SJ, Wozny AS, Fagan-Solis K, Kumar S, Luthman A, Ramsden DA, **Purvis JE**, Gupta GP. Dual inhibition of DNA-PK and DNA polymerase theta overcomes radiation resistance induced by p53 deficiency. (2020) *NAR Cancer* 2(4):zcaa038. PMID: 33385162
- Coryell PR, Goraya SK, Griffin KA, Redick MA, Sisk SR, **Purvis JE**. Autophagy regulates the localization and degradation of $p16^{INK4a}$. (2020) *Aging Cell* 19(7):e13171. PMID: 32662244
- Feng W, Simpson DA, Carvajal-Garcia J, Price BA, Kumar RJ, Mose LE, Wood RD, Rashid N, **Purvis JE**, Parker JS, Ramsden DA, Gupta GP. Genetic Determinants of Cellular Addiction to DNA Polymerase Theta. (2019) *Nature Communications.* PMID: 31537809
- Headley KM, Kedziora KM, Alejo A, Lai EZ, **Purvis JE**, Hathaway NA. Chemical Screen for Epigenetic Barriers to Single Allele Activation of Oct4. (2019) *Stem Cell Research* 38:101470. PMID: 31170660
- Chao HX, Fakhreddin RI, Shimerov HK, Kedziora KM, Kumar RJ, Perez J, Limas JC, Grant GD, Cook JG, Gupta GP, **Purvis JE**. Evidence that the human cell cycle is a series of uncoupled, memoryless phases. (2019) *Molecular Systems Biology* 15(3):e8604. PMID: 30886052
- Grant GD, Kedziora KM, Limas JC, Cook JG, **Purvis JE**. Accurate delineation of cell cycle phase transitions in living cells with PIP-FUCCI. (2018) *Cell Cycle* 17(21-22):2496-2516. PMID: 30421640
- Wolff SC, Kedziora KM, Dumitru R, Dungee CD, Zikry TM, Beltran AS, Haggerty RA, Cheng J, Redick MA, **Purvis JE**. Inheritance of OCT4 predetermines fate choice in human embryonic stem cells. (2018) *Molecular Systems Biology* 14(9):e8140. PMID: 30177503
- Borland D, Yi H, Grant GD, Kedziora KM, Chao HX, Haggerty RA, Kumar J, Wolff SC, Cook JG, **Purvis JE**. The Cell Cycle Browser: an interactive tool for visualizing, simulating, and perturbing cell cycle progression. (2018) *Cell Systems* 7(2):180-184. PMID: 30077635
- Chao HX, Poovey CE, Privette AA, Grant GD, Chao HY, Cook JG, **Purvis JE**. Orchestration of DNA Damage Checkpoint Dynamics across the Human Cell Cycle. (2017) *Cell Systems* 5(5):445-459. PMID: 29102360

- Matson JP, Dumitru R, Coryell P, Baxley RM, Chen W, Twaroski K, Webber BR, Tolar J, Bielinsky AK, **Purvis JE**, Cook JG. Rapid DNA replication origin licensing protects stem cell pluripotency. (2017) *eLife* 6. pii: e30473. PMID: 29148972
- Hafner A, Stewart-Ornstein J, **Purvis JE**, Forrester W, Bulyk M, Lahav G. p53 pulses lead to distinct patterns of gene expression albeit similar DNA binding. (2017) *Nature Structural and Molecular Biology* 24(10):840-847. PMID: 28825732
- Baran-Gale J, **Purvis JE***, Sethupathy P*. An integrative transcriptomics approach identifies miR-503 as a candidate master regulator of the estrogen response in MCF-7 breast cancer cells. (2016) *RNA* 22(10):1592-603. *Co-corresponding authors PMID: 27539783
- Coleman KE, Grant GD, Haggerty RA, Brantley K, Shibata E, Workman BD, Dutta A, Varma D, **Purvis JE**, Cook JG. Sequential replication-coupled destruction at G1/S ensures genome stability. (2015) *Genes and Development* 29(16):1734-46. PMID: 26272819
- Gorman BR, Lu J, Baccei A, Lowry NC, **Purvis JE**, Mangoubi RS, Lerou PH. Multi-scale imaging and informatics pipeline for in situ pluripotent stem cell analysis. (2014) *PLoS One* 31;9(12):e116037. PMID: 25551762
- **Purvis JE**, Karhohs KW, Batchelor E, Loewer A, Lahav G. p53 dynamics control cell fate. (2012) *Science* 336(6087):1440-4. PMID: 22700930
- **Purvis JE**, Shih AJ, Liu Y, Radhakrishnan R. Cancer Cell: Linking Oncogenic Signaling to Molecular Structure. (2011) Chapman Hall CRC Math Comput Biol Ser. 2011:31-44. PMID: 25285322
- Shah PP, Wang T, Kaletsky RL, Myers MC, **Purvis JE**, Jing H, Huryn DM, Greenbaum DC, Smith III AB, Bates P, Diamond SL. A small molecule oxocarbazate inhibitor of human cathepsin L blocks SARS and Ebola pseudotype virus infection into HEK 293T cells. (2010) *Molecular Pharmacology* 78(2):319-24. PMID: 20466822
- Chatterjee MS, **Purvis JE**, Brass LF, Diamond SL. Pairwise agonist scanning predicts cellular signaling responses to combinatorial stimuli. (2010) *Nature Biotechnology* 28(7):727-32. PMID: 20562863
- **Purvis JE**, Radhakrishnan R, Diamond SL. Steady-state kinetic modeling constrains cellular resting states and dynamic behavior. (2009) *PLoS Computational Biology* 5(3):e1000298. PMID: 19266013
- Shih A, **Purvis J**, Radhakrishnan R. Molecular systems biology of ErbB1 signaling: bridging the gap through multiscale modeling and high-performance computing. (2008) *Molecular BioSystems* 4:1142. PMID: 19396377
- Beavers MP, Myers MC, Shah PP, **Purvis JE**, Diamond SL, Cooperman BS, Huryn DM, Smith AB 3rd. Molecular docking of cathepsin L inhibitors in the binding site of papain. (2008) *J Chem Inf Model* 48(7):1464-72. PMID: 18598021
- **Purvis JE**, Chatterjee MS, Brass LF, Diamond SL. A molecular signaling model of platelet phosphoinositide and calcium regulation during homeostasis and P2Y1 activation. (2008) *Blood* 112(10):4069-79. PMID: 18596227
- **Purvis J**, Ilango V, Radhakrishnan R. Role of Network Branching in Eliciting Differential Short-Term Signaling Responses in the Hyper-Sensitive Epidermal Growth Factor Receptor Mutants Implicated in Lung Cancer. (2008) *Biotechnology Progress* 24(3):540-53. PMID: 18412405
- Shah PP, Myers MC, Beavers MP, **Purvis JE**, Jing H, Grieser HJ, Sharlow ER, Napper AD, Huryn

DM, Cooperman BS, Smith AB, Diamond SL. Kinetic Characterization and Molecular Docking of a Novel, Potent, and Selective Slow-binding Inhibitor of Human Cathepsin L. (2008) *Molecular Pharmacology* 74(1):34-41. PMID: 18403718

- Liu Y*, **Purvis J***, Shih A, Weinstein J, Agrawal N, Radhakrishnan R. A multiscale computational approach to dissect early events in the Erb family receptor mediated activation, differential signaling, and relevance to oncogenic transformations. (2007). *Annals of Biomedical Engineering* 35(6):1012-25. **equal contribution*. PMID: 17273938
- **Purvis JE**, Yomano LP, Ingram LO. Enhanced trehalose production improves growth of Escherichia coli under osmotic stress. *Applied and Environmental Microbiology* (2005) 71:3761-9. PMID: 16000787
- Gonzalez R, Tao H, **Purvis JE**, York SW, Shanmugam KT, Ingram LO. Gene array-based identification of changes that contribute to ethanol tolerance in ethanologenic Escherichia coli: comparison of KO11 (parent) to LY01 (resistant mutant). *Biotechnology Progress* (2003) 19:612-23. PMID: 12675606

Review Articles

- Stallaert W, Kedziora KM, Chao HX, **Purvis JE**. Bistable switches as integrators and actuators during cell cycle progression. *FEBS Letters* (2019) 593(20):2805-2816. PMID: 31566708
- Davis DM, **Purvis JE**. Computational Analysis of Signaling Patterns in Single Cells. (2014) *Seminars in Cell and Developmental Biology* 37:35-43. PMCID: 4339661
- Diamond SL, **Purvis J**, Chatterjee M, Flamm MH. Systems biology of platelet-vessel wall interactions. (2013) *Frontiers in Physiology* 4:229. PMCID: 3752459
- **Purvis JE**, Lahav G. Encoding and decoding cellular information through signaling dynamics. (2013) *Cell* 152(5):945-56. PMID: 23452846

Editorials

- Wolff SC, **Purvis JE**. Reprogramming favors the elite. (2019) *Science* 364(6438):330-331. PMID: 31023911
- Haggerty RA, **Purvis JE**. Natural language processing: put your model where your mouth is. (2017) *Molecular Systems Biology* 13(12):958. PMID: 29254950
- Kedziora KM, **Purvis JE**. Cell biology: The persistence of memory. (2017) *Nature* 549(7672):343-4. PMID: 28869963
- **Purvis JE**, Lahav G. Decoding the insulin signal. (2012) *Molecular Cell* 46(6):715-6. PMID: 22749395

Submitted/in press articles

- Mihailovic S, Wolff SC, Kedziora KM, Smiddy NM, Redick MA, Wang Y, Lin GK, Zikry TM, Simon J, Ptacek T, Allbritton NL, Beltran AS, **Purvis JE**. Single-cell dynamics of core pluripotency factors in human pluripotent stem cells. (2022) bioRxiv preprint. In revision at *Stem Cell Reports*. 37 pages.

Conference proceedings

- **Purvis J**, Liu Y, Ilango V, Radhakrishnan R. Efficacy of tyrosine kinase inhibitors in the mutants of

the epidermal growth factor receptor through a multiscale molecular/systems model for phosphorylation and inhibition. (2007) *Proceedings of Foundations of Systems Biology in Engineering II*. pp 289-294.

Invited Talks

- Baylor College of Medicine, Department of Molecular and Cellular Biology (November 6, 2024). *Measuring, Modeling, and Targeting the Cell Cycle.*
- Northwestern University, Department of Cell and Molecular Biology (May 31, 2024). *Measuring, Modeling, and Targeting the Cell Cycle.*
- Northwestern University, Department of Molecular Biosciences (May 30, 2024). *Measuring, Modeling, and Targeting the Cell Cycle.*
- University of Arizona, Department of Molecular and Cellular Biology (December 5, 2023). *Measuring, Modeling, and Targeting the Cell Cycle.*
- University of Toronto, Department of Cell and Systems Biology (October 6, 2023). *Measuring, Modeling, and Targeting the Cell Cycle.*
- Harvard Medical School, Department of Systems Biology (July, 2023). *Measuring, Modeling, and Targeting the Cell Cycle.*
- NIH Division of Systems Biology, Lecture Series (September 2021, Virtual Seminar hosted in Bethesda, MD). *A Walk Around the Cell Cycle.*
- Harvard Medical School Department of Systems Biology, Annual Retreat (June 2019, Phippsburg, ME). *Eternal Sunshine of the Spotless Cycle*.
- Weill Cornell Medicine Physiology, Biophysics and Systems Biology Seminar Series (October 2018, New York, NY). *The lifetime and lineage of an individual cell.*
- UNC/Duke P01 RAS Retreat (May, 2018, Emerald Isle, NC). *Applying single cell signaling dynamics to elucidation of RAS and ERK signaling in cancer.*
- Department of Genetics Research Colloquium (Chapel Hill, NC, May 2018). *Inheritance of OCT4 predetermines fate choice in human embryonic stem cells.*
- UNC GenStat Seminar Series (Chapel Hill, NC, April 2018). *Asymmetric Distribution of OCT4 During Stem Cell Division Alters the Balance Between Self-Renewal and Differentiation*.
- UNC Lineberger Cancer Center Junior Faculty Forum (February, 2018, Chapel Hill, NC). *Fundamentals of cell cycle progression*.
- National Institute of Environmental Health Sciences (NIEHS; Durham, NC, November 2017). *Asymmetric Distribution of OCT4 During Stem Cell Division Alters the Balance Between Self-Renewal and Differentiation.*
- Physical Sciences Oncology Center, University of Pennsylvania (Philadelphia, PA, October 2017). *Phase transitions in single cells*.
- Cancer Cell Biology and Molecular Therapeutics Program Annual Retreat. Lineberger Comprehensive Cancer Center. (Chapel Hill, NC, April 2017). *DNA damage checkpoint dynamics drive cell cycle phase transitions.*
- Fifth Annual Winter Q-Bio Meeting (Kauai, HI, February 2017). *Sibling Cell Rivalry: How Stem Cells Balance Self-Renewal and Differentiation.*

- International Conference on Systems Biology of Human Disease (SBHD) (Boston, MA, June 2016). *Dynamics of OCT4 signaling in human embryonic stem cells.*
- North Carolina State University Program in Genetics Seminar (Raleigh, NC, February 2016). *Single-cell Analysis of Human Stem Cells.*
- The Ninth q-bio Conference (Blacksburg, VA, August 2015). *Single-cell dynamics reflect underlying signaling mechanisms.*
- UNC Epithelial Cell Biology Seminar Series (Chapel Hill, NC, November 2014). *Quantitative single-cell approaches to study differentiation of human epithelia*.
- Institute for Biomedical Informatics/Genomics and Computational Biology Graduate Group Annual Retreat. University of Pennsylvania (Philadelphia, PA, May 2014). *Single-cell dynamics and cell fate decisions.*
- UNC Stem Cell Seminar Series (Chapel Hill, NC, May 2014). *Origins of heterogeneity in human embryonic stem cell differentiation.*
- Center for Gastrointestinal Biology and Disease Seminar Series (Chapel Hill, NC, February 2014). *Heterogeneity in Single-Cell Gene Expression*
- Department of Genetics Research Colloquium (Chapel Hill, NC, January 2014). *Heterogeneity in Single-Cell Gene Expression.*
- NCSU/UNC Regenerative Medicine Symposium (Research Triangle Park, NC, October 2013). *Single-cell analyses in stem cell biology*.
- Innovations in Biocomputing Symposium (Chapel Hill, NC, October 2013). *Guiding Experiments with Computational Models*.
- University of North Carolina Pharmacology Seminar Series (Chapel Hill, NC, April 2012). *p53 signaling dynamics encode cell fate decisions*
- Washington University Center for Genome Sciences and Systems Biology Inaugural Symposium (St. Louis, MO, October 2011). *p53 oscillations encode cell fate information*
- Duke Center for Systems Biology Seminar Series (Durham, NC, September 2011). *p53 oscillations control gene expression and cell fate decisions*
- Cold Spring Harbor Meeting on Computational Cell Biology (Cold Spring Harbor, NY, March 2011). *Transcriptional dynamics and cellular function of p53 pulses*
- Systems Biology of Human Disease (Boston, MA, June 2010). *Transcriptional dynamics and cellular function of p53 pulses*
- American Institute of Chemical Engineers Annual Meeting (Philadelphia, PA, November, 2008). *Reverse engineering the human platelet*
- University of Pennsylvania Center for Bioinformatics Annual Retreat (Philadelphia, PA, November 2008). *Reverse engineering the human platelet*
- Biomedical Engineering Society Annual Meeting (St. Louis, MO, 2008). *Reverse engineering the human platelet*
- American Chemical Society National Meeting (Philadelphia, PA, 2008) *Closing the circuit: Toward network-based identification of drug-sensitivity and resistance mechanisms*
- American Institute of Chemical Engineers Annual Meeting (Salt Lake City, UT, November 2007) *LabML: Automatically connecting experiments and simulations*

- American Institute of Chemical Engineers Annual Meeting (Salt Lake City, UT, November 2007) *A multiscale systems model for platelet signaling and activation*
- Biomedical Engineering Society Annual Meeting (Los Angeles, CA, September 2007). *A multiscale systems model for platelet signaling and activation*
- American Society for Microbiology Southeastern Meeting – (Athens, GA, October 2003) *Enhanced trehalose production in* E. coli

Published Meeting Abstracts

- Shahir JA, Stanley N, Purvis JE. *Cellograph: A Semi-supervised Approach to Analyzing Multi-condition Single-cell RNA-sequencing Data Using Graph Neural Networks*. Single-cell Genomics Conference. Utrecht, The Netherlands. October, 2022.
- Shahir JA, Wolff SC, Zahabouian A, Beltran A, Purvis JE. *Elucidating the role of the cell cycle in human stem cell differentiation using multiplexed imaging*. International Society for Stem Cell Research Annual Meeting. San Francisco, CA (hybrid). June 2022.
- Shahir JA, Wolff SC, Zahabouian A, Beltran A, Purvis JE. *Elucidating the role of the cell cycle in human stem cell differentiation using multiplexed imaging*. Winter q-Bio Annual Meeting. Kapolei, Oahu, Hawaii. February 2022.
- Kedziora KM, Grant GD, Limas JC, Purvis JE, Cook JG. *Different paths into S phase: visualizing APC activity at the G1/S border with PIP-FUCCI*. Salk Institute Cell Cycle Meeting, San Diego, CA. June, 2018.
- Chao HX, Fakhreddin RI, Shimerov HK, Kumar RJ, Gupta GP, Purvis JE. *Evidence that the human cell cycle is a series of memoryless steps*. International Conference on Systems Biology of Human Disease. Los Angeles, CA. June, 2018.
- Coryell PR, Purvis JE. *Lysosomes degrade p16INK4a and regulate its transport upon cellular stress*. Abstract for poster presentation. 11th annual international conference on Systems biology of human diseases, Los Angeles, CA, June 2018.
- Wolff SC, Beltran AS, Smiddy NM, Kedziora KM, Popova M, Kiang S, Allbritton NL, Purvis JE. *Rapid engineering of human embryonic stem cell lines expressing endogenous fluorescent reporters for OCT4, NANOG and SOX2*. International Society for Stem Cell Research (ISSCR) annual meeting. Melbourne, Australia. June, 2018.
- Wolff SC, Beltran AS, Smiddy NM, Kedziora KM, Popova M, Kiang S, Allbritton NL, Purvis JE. *Rapid engineering of human embryonic stem cell lines expressing endogenous fluorescent reporters for OCT4, NANOG and SOX2*. Precision CRISPR Stem Cell Meeting. Seattle, WA. June, 2018.
- Chao HX, Fakhreddin RI, Shimerov HK, Kumar RJ, Gupta GP, and Purvis JE. *Evidence that the human cell cycle is a series of memoryless steps*. Winter q-Bio Conference. Maui, HI. February, 2018.
- Haggerty RA, Baran-Gale J, Purvis JE. *Mechanism Inference from Single Cells (MISC)*. Winter q-bio Conference, Maui, Hawaii, February 2018.
- Dungee C, Pietryk E, Xue J, Beltran A, Wolff C, Ideraabdullah F, Purvis J. *DNA methylation of OCT4 proximal promoter in human embryonic stem cells*. Annual Biomedical Research Conference for Minority Students (ABRCMS). Phoenix, AZ. November, 2017.
- Chao HX, Poovey CE, Privette AA, Gavin D. Grant GD, Jeanette G. Cook JG, and Purvis JE. *DNA damage checkpoints impose phase-specific stringencies and temporal locations. Summer q-Bio Conference*. New Brunswick, NJ. July, 2017.

- Wolff SC, Dumitru R, Dungee CD, Kedziora KM, Haggerty RA, Cheng J, Purvis JE. *Dynamics of OCT4 signaling in human embryonic stem cells*. International Society for Stem Cell Research (ISSCR) annual meeting. Boston, MA. June, 2017.
- Wolff SC, Dumitru R, Dungee CD, Kedziora KM, Haggerty RA, Cheng J, Purvis JE. *Dynamics of OCT4 signaling in human embryonic stem cells*. Duke Q-bio Symposium. Durham, NC. May, 2017.
- Chao HX, Poovey CE, Privette AA, Gavin D. Grant GD, Jeanette G. Cook JG, and Purvis JE. *DNA damage checkpoints impose phase-specific stringencies and temporal locations*. Duke q-Bio Symposium. Durham, NC. May, 2017.
- Wolff SC, Dumitru R, Dungee CD, Cheng J, Purvis JE. *Development of a live-cell reporter for human embryonic stem cell differentiation*. Winter Q-Bio Meeting. Kauai, Hawaii. February 2017.
- Haggerty RA, Baran-Gale J, Purvis JE. *Mechanism Inference from Single Cells (MISC)*. Abstract for poster presentation. 2015. Winter q-bio Conference 2017, Kauai, Hawaii, February 2017.
- Chao HX, Poovey CE, Privette AA, Gavin D. Grant GD, Jeanette G. Cook JG, and Purvis JE. *DNA damage checkpoints impose phase-specific stringencies and temporal locations*. Winter q-Bio Conference. Kauai, HI. February, 2017.
- Wolff SC, Dumitru R, Dungee CD, Haggerty RA, Cheng J, Purvis JE. *Dynamics of OCT4 signaling in human embryonic stem cells.* International Conference on Systems Biology of Human Disease. Boston, MA. June, 2016.
- Chao HX, Purvis JE. *Regulation of endogenous DNA damage in CUL9-deficient cells*. International Conference on Systems Biology of Human Disease. Boston, MA. June, 2016.
- Dungee C, Wolff SC, Dumitru R, Cheng JG, Purvis JE. *Dynamics of the NANOG-GATA6 axis in human embryonic stem cells*. Annual Biomedical Research Conference for Minority Students (ABRCMS). Seattle, WA, November, 2015.
- Haggerty RA, Baran-Gale J, Purvis JE. *Mechanism Inference from Single Cells (MISC)*. The Ninth q-bio Conference, Blacksburg, Virginia, August, 2015.

Patent

- Diamond SL, Chatterjee, MS, Purvis JE. *Methods for Predicting Cellular Signaling Responses to Combinatorial Stimuli*. No. PCT/US11/40712, filed June 16, 2011.

TEACHING RECORD

Courses

2024	Lecturer	BIOC742/PHCO742: Contemporary Topics in Cell Signaling: The Cell Cycle University of North Carolina at Chapel Hill Spring semester, 1.5 contact hours
2023	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 8 students, 15 contact hours
2022 – 2023	Leader	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program

		University of North Carolina at Chapel Hill Fall/Spring semesters, 13 students, 30 contact hours
2022	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 9 students, 15 contact hours
2021 – 2022	Leader	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program University of North Carolina at Chapel Hill Fall/Spring semesters, 13 students, 30 contact hours
2021	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 5 students, 15 contact hours
2020 – 2021	Leader	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program University of North Carolina at Chapel Hill Fall/Spring semesters, 13 students, 30 contact hours
2020	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 9 students, 15 contact hours
2019 – 2020	Leader	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program University of North Carolina at Chapel Hill Fall/Spring semesters, 13 students, 30 contact hours
2019	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 9 students, 15 contact hours
2018 – 2019	Co-Mentor	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program University of North Carolina at Chapel Hill Fall/Spring semesters, 15 students, 15 contact hours
2018	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 5 students, 15 contact hours
2017	Course Director	BCB 718: Computational Modeling Laboratory University of North Carolina at Chapel Hill Spring semester, 9 students, 15 contact hours
2016 – 2017	Co-Mentor	BBSP 902: First-Year Group for Biological and Biomedical Sciences Program University of North Carolina at Chapel Hill Fall/Spring semesters, 15 students, 15 contact hours

2016	Lecturer	Summer Research Program in Biophysics University of North Carolina at Chapel Hill Summer Session I, 15 students, 1 contact hour
2016	Co-Course Director	BCB 715: Bioinformatics and Mathematics Modeling University of North Carolina at Chapel Hill Spring semester, 30 students, 3 contact hours
2016	Lecturer	PHCO 743: Contemporary Topics in Cell Signaling Signaling Networks University of North Carolina at Chapel Hill Spring semester, 10 students, 1.5 contact hours
2015	Lecturer	Summer Research Program in Biophysics University of North Carolina at Chapel Hill Summer session I, 20 students, 1.5 contact hours
2015	Course Director	BCB 715: Introduction to Computational Modeling of Cellular Signaling Systems Spring semester, 15 students, 20 contact hours
2014	Co-Course Director	GNET 702: Student Seminars University of North Carolina at Chapel Hill Fall semester, 40 students, 15 contact hours
2010	Teaching Fellow	SB 203: Measurement and Modeling in Systems Biology Harvard Medical School 4 Students
2009	Teaching Fellow	SB 202: Fundamentals of Quantitative and Systems Biology Harvard Medical School 10 Students
2009	Section Leader	NSF Workshop on Systems Biology University of Pennsylvania 30 Students
2008	Lecturer	BE 513: Cell Biology University of Pennsylvania 40 Students
2005	Course Instructor	Geometry Manatee County School Board 25 Students
2004	Course Instructor	Algebra Manatee County School Board 25 Students

2003	Lecturer	MCB 4403: Prokaryotic Cell Structure and Function University of Florida 25 Students
2003	Teaching Assistant	MCB 4304: Advanced Microbiology Lab University of Florida 25 Students

Fixed-Term Faculty Mentored

2020 – 2022	Dr. Kasia Kedziora	Currently Research Assistant Professor of Cell Biology at the University of Pittsburg
2019 –	Dr. Sam Wolff	Assistant Professor, Genetics, UNC Chapel Hill
2018 –	Dr. Keriayn Smith	Assistant Professor, Genetics, UNC Chapel Hill

Postdoctoral Researchers Supervised

2024 – Dr. Timothy Daugird
Project Focus: Cell cycle plasticity and drug resistance in ER+ breast cancer

2018 – 2022 Dr. Wayne Stallaert
Project focus: Oncogenic RAS Signaling in Single Human Cells
Current Position: Assistant Professor of Computational and Systems Biology, University of Pittsburg

2016 – 2020 Dr. Kasia Kedziora
Project focus: Cell Cycle Phase Transitions in Single Human Cells
Current Position: Research Assistant Professor of Cell Biology, University of Pittsburg

2014 – 2019 Dr. Sam Wolff
Project focus: Single-Cell Imaging
Current Position: Assistant Professor of Genetics, UNC Chapel Hill

2014 – 2015 Dr. Denise Davis
Project focus: Regulation of $p16^{INK4a}$ in human neural progenitor cells
Current position: Clinical Research Associate at Quintiles Transnational, INC

PhD Students Supervised

2022 – Garrett Sessions, Cell Biology and Physiology Graduate Student
Thesis title: Molecular control of senescence in human and mouse models

2018 – 2023 Jamshaid Shahir, Bioinformatics and Computational Biology Graduate Student, NSF Graduate Research Fellow, Royster Fellow
Thesis title: Interplay between stem cell differentiation and proliferation
Tentative defense date: June, 2023

2019 – Tarek Zikry, Biostatistics Graduate Student, NRSA Graduate Fellow
Co-Supervised with Dr. Michael Kosorok

Thesis title: Methods for integration and projection of single-cell proteomic data
Tentative defense date: January, 2024

2018 – 2023 Jolene Ranek, Bioinformatics and Computational Biology Graduate Student, NRSA Graduate Fellow
Co-Supervised with Dr. Natalie Stanley
Thesis title: Integration and Feature Selection in Single-Cell Data

2018 – 2023 Sonja Mihailovic, Genetics and Molecular Biology Graduate Student
Co-Supervised with Dr. Adriana Beltran
Thesis title: Single-cell dynamics in human pluripotent stem cells

2015 – 2018 Sherry Chao, Bioinformatics and Computational Biology Graduate Student
Thesis title: Role of CUL9 in regulation of endogenous DNA damage
Defense date: December 3, 2018
Current Position: Resident Physician in Internal Medicine, UCSF

2014 – 2019 Philip Coryell, Genetics and Molecular Biology Graduate Student with a certificate in Bioinformatics and Computational Biology
Thesis title: Dynamics and Localization of the Tumor Suppressor $p16^{ink4a}$
Defense date: November 11, 2019
Current Position: Postdoctoral Fellow with Dr. Richard Loeser, UNC Chapel Hill

2014 – 2019 Rachel Haggerty, Bioinformatics and Computational Biology Graduate Student
Thesis title: Mechanism Inference from Single Cells
Defense date: November 11, 2019
Current Position: Postdoctoral Fellow with Douglas Fitzpatrick, UNC Chapel Hill

2014 – 2016 Jeanette Baran-Gale, Bioinformatics and Computational Biology Graduate Student
Thesis title: Dynamics of mRNA and microRNA expression in the estrogen response
Co-Supervised with Praveen Sethupathy
Defense date: April 4, 2016
Current Position: Postdoctoral Fellow with Chris Ponting, University of Edinburgh

Post-baccalaureate Student Supervised

2017 – 2018 Cierra Dungee, B.A. in Mathematics, Minor in Biology and Medical Anthropology, University of North Carolina at Chapel Hill
Project: Epigenetics of early differentiation of human stem cells
Next Position: Ph.D. Student in Bioinformatics and Computational Biology

Undergraduate Researchers Supervised

Spring 2023 – Aditya Iyer
Coordination of Cell Cycle Progression and Differentiation of Human Embryonic Stem Cells

Spring 2023 – Madeline Loops
Dynamics of Senescence in Human Epithelial Cells

Fall 2022 – Abigail Creasy

	Job coaching for neurodiverse lab members
Fall 2021 –	Harris Davis Iterative immunofluorescence of primary human tumors
Fall 2021 –	Ander Naugle Iterative immunofluorescence of human stem cells
2021 – 2023	Amirsaman Zahabioun Iterative immunofluorescence of primary human tumors
Fall 2021 –	Olivia Wen Analysis of single-cell proteomic data from primary human tumors
2020 – 2021	Colin Taylor Development of iterative immunofluorescence platform for single cell analysis Next position: PhD student at UCSD
2019 – 2022	Guang Lin Single-cell dynamics of human stem cell differentiation to cardiomyocytes Next position: MS student in public health at UNC
2019 – 2021	Holly Sobon Single-cell dynamics of cell cycle progression and arrest Next position: MD student at ECU
2019 – 2021	Catherine Young Single-cell dynamics of cell cycle progression and arrest
2019 – 2022	Sovanny Taylor Single-cell dynamics of cell cycle progression and arrest Next position: PhD student at Baylor University
2019 – 2021	Lailani Cruz-Alvarez Single-cell dynamics of cell cycle progression and arrest
2017 – 2019	Randy Fakhreddin, Major in Biology, Minor in Chemistry and Neuroscience Project: Cell Cycle Progression in Single Human Cells
2017 – 2018	Hristo Shimerov, Major in Biology and Psychology Project: Cell Cycle Progression in Single Human Cells
2017 – 2018	Samuel Sisk p16 localization and aging
2017 – 2018	Tarek Zikry, Major in Biostatistics Honors Thesis Topic: Computational modeling of human stem cell fate decisions
2016 – 2018	Supreet Goraya, Major in Biology, Minor in Medical Anthropology Project: Localization of $p16^{INK4a}$ in human cells
2016 – 2018	Kathrine Griffin, Double Major in Biology and Computer Science

	Project: Localization of $p16^{INK4a}$ in human cells
2015 – 2017	Cere Poovey, Major in Biology Project: Role of DNA damage in cell cycle progression
2014 – 2017	Cierra Dungee, Major in Mathematics, Minor in Biology and Medical Anthropology Project: Dynamics of the NANOG-GATA6 axis in human embryonic stem cells
2017 – 2018	Chi Pham, Major in Biology Project: Dynamics of CDK2 at the S/G2 Transition
2015 – 2017	Ashley Privette, Major in Biology Project: Role of DNA damage in cell cycle progression
Summer 2016	Peijie ("Jordan") Sun Project: BMP4-controlled specification of mesoderm in human embryonic stem cells
Summer 2014	Adrian Breckheimer, SURE Undergraduate Student Project: Dynamics p38 and p16 signaling in human cells

Rotation Students Supervised

2023 (Winter)	Omar El Merhebi, Bioinformatics and Computational Biology
2023 (Winter)	Leah Frazier, Pharmacology
2022 (Summer)	Gregory Alspaugh, Bioinformatics and Computational Biology
2022 (Spring)	Garrett Sessions, Cell Biology and Physiology
2020 (Summer)	Matthew Sutcliffe, Bioinformatics and Computational Biology
2020 (Winter)	Amjad Dabi, Bioinformatics and Computational Biology
2019 (Spring)	Jolene Ranek, Bioinformatics and Computational Biology
2018 (Winter)	Sonja Mihailovic, Genetics and Molecular Biology
2018 (Fall)	Priya Stepp, Cell Biology and Physiology
2018 (Fall)	Jamshaid Shahir, Bioinformatics and Computational Biology
2018 (Spring)	Hang Su, Bioinformatics and Computational Biology
2017 (Fall)	Mariya Popova, Bioinformatics and Computational Biology
2017 (Fall)	Andrew Hinton, Bioinformatics and Computational Biology
2016 (Fall)	Jaya Kumar, Bioinformatics and Computational Biology
2016 (Fall)	Daniel Sprague, Genetics and Molecular Biology

2015 (Fall)	Kimiko Suzuki, Bioinformatics and Computational Biology
2015 (Summer)	Hui Xiao ("Sherry") Chao, MD/PhD and Bioinformatics and Computational Biology
2014 (Spring)	Rachel Haggerty, Bioinformatics and Computational Biology
2014 (Winter)	Philip Coryell, Genetics and Molecular Biology and Bioinformatics and Computational Biology Certificate
2014 (Winter)	Luke Laudermilk, Genetics and Molecular Biology
2014 (Winter)	Alisha Coffey, Genetics and Molecular Biology
2013 (Fall)	Natalie Stanley, Bioinformatics and Computational Biology Co-Mentored with Praveen Sethupathy

Mentoring Committee Member for Fixed-Term Faculty and Postdoctoral Researchers

Joseph Burclaff	Postdoctoral Fellow	Fall 2019 – present
Gavin Grant	Postdoctoral Fellow	Spring 2015 – Summer 2019
Brian Diekman	Postdoctoral Fellow (Current Position: Tenure-track faculty in BME Department at UNC)	Spring 2015 – Fall 2016

PhD Committee Member

Samuel Hawke	Biostatistics	Summer 2024 –	
Keith Breau	CBP Program	Spring 2022 –	
Jiali Zhu	BCB Program	Spring 2022 –	
Haeun Hwangbo	BCB Program	Fall 2021 – Spring 2024	Chair
Dalia Fleifel	GMB Program	Spring 2021 –	
Jiawei Zhou	DPET Program	Fall 2019 – Spring 2022	
Joseph Foster	BCB Program	Fall 2019 – Spring 2024	Chair
Odessa Goudy	Biophysics program	Fall 2018 – Spring 2023	
Andrew Hinton	BCB program	Fall 2018 – Spring 2022	Chair
William Weir	BCB/MD/PhD program	Fall 2018 – Spring 2020	Chair
Shaye Hagler	Pharmacy Program	Spring 2017 – Summer 2019	
Xiaokang Yan	Pharmacy Program	Spring 2018 – Spring 2023	
Kimiko Suzuki	BCB program	Fall 2017 – Spring 2021	Chair
Kshitij Sharma	CBP Program	Fall 2017 – Summer 2022	
Frank Teets	BCB program	Spring 2017 – Spring 2020	Chair
Rashmi Kumar	MD/PhD program	Spring 2017 – Spring 2021	
Josh Wooten	GMB program	Spring 2016 – Spring 2020	
Charlie Hodgens	GMB program	Fall 2015 – Summer 2020	
Paul Maurizio	BCB program	Fall 2015 – Spring 2018	
Joshua Welch	CS program	Fall 2015 – Spring 2017	
Natalie Stanley	BCB program	Fall 2015 – Spring 2018	Chair

GRANTS

Active research support

R01-CA280482 NIH/NCI $2,487,128 Role: PI 13% effort 04/01/2023-03/31/2028
Cell cycle paths as a framework for understanding drug resistance in tumor cell subpopulations

R01-AG081734 NIH/NIA $1,828,564 Role: Co-I 5% effort 04/01/2023- 03/31/2028
Role of DNA damage and cellular senescence in osteoarthritis pathophysiology
This grant scored in the 4th percentile and is under consideration for funding.

NSF- 2242980 $788,516 Role: PI 17% effort 03/01/2023-02/28/2027
Toward a revised model of the cell cycle that captures reversible and irreversible arrest

R01-GM138834 NIH/NIGMS $1,351,239 Role: PI 22% effort 08/01/2020 – 07/31/2024
Computational Models of the Human Cell Cycle to Reveal Disease Mechanism and Inform Treatment

F31-HL156433 NIH/NHLBI $112,650 Role: PI 0% effort 04/02/2021 – 03/31/2024
Inferring Gene Regulatory Networks Governing Definitive Endoderm Differentiation from Single CellRNA Velocity Measurements

F31-HL156464 NIH/NHLBI $148,136 Role: PI 0% effort 01/01/2021 – 12/31/2024
Deep learning models to predict primitive streak formation in human development

Burroughs Wellcome Fund $5,000 Role: PI 0% effort 11/01/2021 – 09/01/2023
Cell cycle remodeling during human stem cell differentiation

SOM ECBR Award $50,000 Role: Co-PI 0% effort 1/01/2023 – 12/31/2023
Identifying the role of local cell-type neighborhoods on catecholamine-induced focal necrosis

R01-GM138834-S1 NIH/OD $170,006 Role: PI 0% effort 08/01/2020-07/31/2024
This administrative equipment supplement supports the purchase of a new microscope

Pending research support

R01-CA276937 NIH/NCI $2,444,875 Role: PI 10% effort 04/01/2023- 03/31/2028
Augmenting vulnerability to Polymerase theta inhibition in cancer therapy

Completed research support

NSF CAREER $777,354 Role: PI 17% effort 1/01/2019 – 12/23/2023
Predicting cell fate from cell history: theory, experiment, and outreach

R01GM138834-S2 NIH/NIGMS $6,794 Role: PI 0% effort 06/01/2023 – 07/31/2023
Undergraduate Support Administrative Supplement: Computational Models of the Human Cell Cycle to Reveal Disease Mechanism and Inform Treatment

Chan Zuckerburg Initiative $433,009 Role: Faculty Advisor 0% 12/01/2020 – 11/30/2023
Empowering biologists with deep learning approaches to image analysis

UNC SOM BOOST Award $24,932 Role: PI 0% effort 07/01/2022-12/31/2022
To support the P01 proposal: Modeling and Targeting the Cell Cycle for Breast Cancer

R56-AG066911-01A1 NIH/NIA $316,162 Role: Co-I 5% effort 09/30/2021 – 08/31/2022
Understanding the role of cellular senescence in osteoarthritis: dynamics, clearance, and mechanisms of induction

Dept. of Genetics PIVOT Award $19,960 Role: PI 0% effort 05/01/2022-08/31/2022
To support preparation of a new R01 in collaboration with Dr. Nancy Allbritton (UWash)

F30-CA213876 NIH/NCI $110,397 Role: PI 0% effort 06/01/2017–07/31/2021
Defining the quantitative relationship between DNA damage and cell cycle dynamics in CUL9-deficient cells

DP2-HD091800 NIH/OD $1,500,000 Role: PI 41% effort 9/30/2016 – 6/30/2021
Controlling Stem Cell Fate through Computational Modeling

DP2-HD091800-S1 NIH/OD $37,092 Role: PI 0% effort 9/30/2016 – 6/30/2021
This administrative supplement to enhance diversity supported a postbaccalaureate researcher.

Comp. Med. Pilot Award $50,000 Role: Co-PI 0% effort 1/01/2020 – 12/31/2020
A topological model of the cell cycle in KRAS-driven cancers
This pilot grant uses concepts from topology, graph theory, and stochastic simulation to build a mathematical model of how the cell cycle changes in response to oncogenic KRAS.
Co-PI: Channing Der

F31-HL134336 NIH/NHLBI $94,929 Role: PI 0% effort 09/01/2016–08/31/2019
Single-cell dynamics of the OCT4-GATA6 axis in human lung progenitors

W. M. Keck Foundation $1,300,000 Role: Co-PI 20% effort 7/01/2015 – 6/30/2019
(Multiple-PI Grant)
Systematic Assembly of the Sequence of Molecular Events in the Human Cell Cycle
The goal of this project is to assemble a real-time map of the human cell cycle through the use of live-cell microscopy and computational modeling.
Co-PI: Jeanette Cook

UNC LCCC Innovation Award $60,000 Role: Co-PI 0% effort 1/01/2015 – 12/31/2016
Single-cell analysis of cytoplasmic regulation of p53 by Cul9
The goal of this project is to use single-cell analysis and light-regulated protein subcellular localization to study the temporal and spatial regulation of p53 by CUL9.
PI: Yue Xiong; Co-PI: Klaus Hahn

NIH/NIGMS R00-GM102372 $750,000 Role: PI 30% effort 9/01/2013 - 8/31/2016
Dynamics of cellular senescence in single human cells
The goal of this project is to investigate the timing and control of cellular senescence in single human cells.

NIH/NIGMS R00-GM102372-S1 $15,522 Role: PI 0% effort 9/01/2013 - 8/31/2016
Dynamics of cellular senescence in single human cells
This administrative supplement to enhance diversity supported a postdoctoral researcher.

Junior Faculty Development Award $7,500 Role: PI 0% effort 1/01/2015 – 12/31/2015
Monitoring stem cell differentiation in real time and at single-cell resolution

The goal of this project is to develop a live-cell reporter for SOX17, a marker of definitive endoderm (DE).

NIH/NIDDK P30-DK034987 $30,000 Role: Pilot Award 0% 7/01/2014 - 6/30/2015
Making definitive endoderm from human stem cells
The goal of this pilot study is to identify genes that regulate the differentiation of definitive endoderm from human embryonic stem cells using single-cell genomic approaches.

NIH/NIGMS K99-GM102372 $90,000 Role: PI 100% effort 9/01/2012 - 8/31/2013
Dynamics of cellular senescence in single human cells
The aim is to investigate the timing and control of cellular senescence in single human cells.

NIH/NIGMS F32-GM095168 Role: Postdoctoral award 100% 7/01/2010 – 8/31/2012
Transcriptional dynamics and cellular function of p53 pulses
The aim is to discover the functional role of p53 dynamics in response to DNA damage.

NIH/NHGRI T32-HG000046 Role: Awarded Trainee 100% 7/01/2008 – 8/31/2009
Quantifying the response of human platelets to combinatorial inputs
The aim is to understand how platelets integrate multiple receptor-mediated signals.

PROFESSIONAL SERVICE

To Discipline

Referee for *Nature, Science, Cell, Proceedings of the National Academy of Sciences, Nature Chemical Biology, Nature Cell Biology, Molecular Systems Biology, Molecular Cell, Cell Systems, Nature Communications, Current Biology, PLOS Computational Biology, Biophysical Journal, BMC Biology, BMC Systems Biology, Journal of Biological Chemistry*

Co-Chair, NIH/MABS Study Section	February 2024 – June 2024
Appointed NIH/MABS Study Section, Standing Member	July 2023 – June 2027
NIH/MABS Study Section, *ad hoc* Member	June 2023
NIH/MABS Study Section, *ad hoc* Member	February 2023
NSF Science Technology Center Site Visit Panelist	February 2023
NIH/MABS Study Section, *ad hoc* Member	October 2022
NIH/MABS Study Section, *ad hoc* Member	June 2022
NIH/MABS Study Section, *ad hoc* Member	October 2021
NSF/CAREER Panel Review	October 2021
NSF/GEAR Grant Review	January 2020
NSF/NIGMS Grant Review Panel	December 2013

Within UNC

EDGE Genomics Advisory Committee	October 2024 - present
Reviewer for 2024 Creativity Hubs Finalists Office of the Vice Chancellor for Research	May 2024
School of Medicine Strategic Plan Work Group: People Pillar Co-Chairs: Jill Jemison and Michael Kane	March 2024
School of Medicine Strategic Plan Work Group: Research Pillar Co-Chairs: John Buse and Mylen Cohen	February 2024
Organizer for 2024 Computational Medicine Symposium	March 2024
Jefferson-Pilot Fellowships in Academic Medicine Review Committee Chair: Trisha Dant, Office of Research	October 2023
Bioinformatics and Computational Biology Executive Committee Chair: Will Valdar	July 2023 – present
Computational Medicine Screenwriting Committee	Summer 2023
Computational Medicine Faculty Search Committee Chairs: Tim Elston and Chuck Perou	Spring 2023
Bioinformatics and Computational Biology Qualifying Exam Committee Chair: Will Valdar	Spring 2023
Genetics and Molecular Biology Qualifying Exam Committee Chair: Jeff Sekelsky	Spring 2022
Genetics and Molecular Biology Qualifying Exam Committee Chair: Jeff Sekelsky	Spring 2021
Bioinformatics and Computational Biology Qualifying Exam Committee Chair: Will Valdar	Spring 2021
Bioinformatics and Computational Biology Qualifying Exam Committee Chair: Will Valdar	Spring 2020
Department of Genetics Advisory Committee Chair: Fernando Pardo Manuel de Villena	Fall 2019 - Spring 2021
Genetics Faculty Search Committee Chair: Karen Mohlke	Fall 2019 - Spring 2020
Bioinformatics and Computational Biology Qualifying Exam Committee Chair: Will Valdar	Spring 2019
Department of Genetics Advisory Committee Chair: Fernando Pardo Manuel de Villena	Fall 2018 - Spring 2019

Computational Medicine Faculty Search Committee (2 positions) — Fall 2018 - Spring 2019
Chairs: Tim Elston and Chuck Perou

Bioinformatics and Computational Biology Qualifying Exam Committee — Spring 2018
Chair: Will Valdar

Bioinformatics and Computational Biology Admissions Committee — Fall 2017 - Spring 2018
Chair: Michael Jarstfer

University Cancer Research Fund Innovation Award Review Panel — Fall 2017
Chair: Al Baldwin

Discussion Leader, PI Development Series Module on Lab Management and Budgeting
Organizer: Sohini Sengupta — March 2017

W.M. Keck Faculty Advisory Committee — January 2017
Organizer: Brooke Church

BBSP Quantitative Biology Admissions Committee — Spring 2017

Bioinformatics and Computational Biology Curriculum Committee — Spring 2016
Chair: Tim Elston

Computational Medicine Advisory Committee — 2015
Chair: Gary Johnson

University Cancer Research Fund Innovation Award Review Panel — Fall 2015
Chair: Jim Bear

University Cancer Research Fund Innovation Award Review Panel — Spring 2015
Chair: Kim Rathmell

Faculty Search Committee Member for Neuroscience/Genetics Position — 2014 – 2015
Chair: Bill Snider
Successful hiring of Dr. Jason Stein

Assistant Professor Advisory Committee — Fall 2014
Chair: Bob Duronio

<u>Beyond UNC</u>

Duke Center for Christianity and Scholarship, Faculty Theological Intensive — Summer 2023

Developing a Christian Mind at Oxford, Oxford, UK — Winter 2023

UNC Veritas Forum, Moderator — Winter 2022

Triangle Faculty Roundtable, Co-Chair — Spring 2021

Triangle Faculty Roundtable, Emcee — Winter 2021

Triangle Faculty Roundtable, Co-Chair Fall 2020

UNC Veritas Forum, Platform Partner with Ian Hutchinson Fall 2017

RESEARCH STATEMENT

My primary research interest is developing computational models that can help us understand and manipulate cellular behavior. Our interdisciplinary research group—which includes molecular biologists, statisticians, mathematicians, and computer scientists—strives to build models that make experimentally-testable predictions that are then validated in our laboratory. Over the past ten years, we have built models to understand cellular behavior in a variety of biological contexts including the response to DNA damage and the maintenance of stem cell pluripotency. Collectively, these studies have advanced our conceptual understanding of single-cell behaviors and revealed the remarkable sophistication with which individual cells make fate decisions.

In 2016, my colleague Dr. Jeanette Cook (Biochemistry and Biophysics, UNC) and I were awarded a Medical Research Grant from the W. M. Keck Foundation. This collaborative team-science grant would mark the beginning of a major shift in direction for our laboratory. We are now heavily focused on understanding the overall organization and function of the human cell cycle. We have developed cutting-edge methods to measure, visualize, understand, and predict cell cycle behaviors in single cells. This includes the development of novel fluorescent reporter systems as well as new multiplexed single-cell microscopy techniques. A particular strength of our lab is to apply new computational approaches, such as manifold learning methods, to analyze and interpret these data sets. These approaches have revealed how cell cycle kinetics are governed in individual cells; how cells inherit information from the previous cell cycle; and how cell cycle checkpoints are executed throughout the cell cycle. Our discoveries have led to multiple high-impact publications, invitations to present our work at international venues, and extramural funding from the National Science Foundation and the National Institutes of Health.

Going forward, our lab will address four fundamental aspects of cell cycle regulation: plasticity, generativity, directionality, and dysregulation. We will ask: How does the cell cycle adjust to changing environmental and developmental cues? What does a cell inherit from the previous cell cycle and how does this inheritance affect its fate? Are some cell cycle arrest states truly irreversible and, if so, what are the molecular states that define those points-of-no-return? And, finally, how does the cell cycle vary in its organization and behavior among tumor subtypes, and can we define cell cycle signatures that predict patient responses to targeted therapy? Using novel imaging techniques and modeling approaches, we will build comprehensive cell cycle structures to advance our understanding of how the cell cycle functions in physiology and disease.

One of these future directions—the study of cell cycle dysregulation—deserves special mention because of its enormous translational promise. In collaboration with Molecular Oncologists Dr. Charles Perou (Genetics) and Dr. Philip Spanheimer (Surgery), we have now applied single-cell imaging approaches to study the cell cycle in estrogen receptor-positive (ER+) breast tumors resected from patients at UNC hospitals. Our collaborative work has led to a new conceptual framework in which we believe that all ER+ tumors show some degree of resistance to endocrine therapy and CDK4/6 inhibitors, but the extent of resistance depends on the unique cell cycle behaviors present in that tumor. Using interdisciplinary approaches, we will determine how cell cycle heterogeneity in ER+ tumors drives resistance to endocrine/CDK4/6 inhibitor therapy. We will use this knowledge to develop a biomarker that predicts clinical benefit for addition of CDK4/6 inhibitors and test a class of new drug targets that we predict will reduce the number of resistant tumor cells. If successful, our research will have a major impact on our fundamental understanding of drug resistance mechanisms; develop the next-generation biomarkers to guide clinical decision-making; and characterize a new class of drug targets that could help overcome CDK4/6 inhibitor therapeutic resistance in breast cancer patients.

March 14, 2025

TEACHING STATEMENT

I am strongly committed to teaching University students both as an advisor to graduate students and postdoctoral researchers, as well as through graduate-level course instruction. I recognize that the students I teach will continue their work and education for many years after I have retired; that they collectively possess an enormous variety of individual talents and abilities; and that they will gain access to new concepts and technologies that I can only imagine. I therefore view excellence in teaching as a multiplication of my academic effort.

My primary teaching responsibility is to train graduate students and postdoctoral researchers to become skilled, knowledgeable, and independent scientists. I enjoy this role immensely. With each trainee, I strive to establish a supportive and cooperative but also rigorous research environment; to provide guidance tailored to the needs of the trainee; and to encourage the development of scientific independence. For each trainee, I develop a tailored and specific training plan that includes elements of Computational Biology, Experimental Cell Biology, and Career Development. I meet with all of my trainees regularly and frequently—about once per week—to discuss the specifics of their projects and preliminary results. In these discussions we cover not only the technical aspects of their work, but also the recent literature and broader questions in the field of computational cell biology. I encourage and assist all of my students to apply for extramural fellowships, and the majority of my students have received some form of fellowship or award to support their research. I also provide opportunities for trainees to engage in mentorship of junior scientists. We host a continuous stream of rotating first-year graduate students, summer undergraduate fellows, and federal work study assistants.

My research group meets each week for 1-2 hours. At the weekly meetings, a lab member presents recent computational or experimental results, a journal article, or a report from attendance at a scientific conference. We engage regularly with collaborating labs including Drs. Gaorav Gupta, Jeanette Cook, Chuck Perou, Tim Elston, and Phil Spanheimer to discuss ongoing collaborative projects. These accomplished scientists provide additional guidance and mentorship for my students and trainees. I make a specific effort to foster interactions between our trainees and the PIs of our collaborating labs so that they have more than one perspective and can rely on those professors for both scientific and career advice. My students routinely present their work in weekly seminars and at annual departmental retreats. It is important to me that my trainees can successfully communicate their computational work to a broad audience, and I provide multiple opportunities to do so. I support all of my trainees to attend international meetings relevant to their specific interest both to present their findings as well as to interact with the wider scientific community.

Since joining the faculty at UNC, I have served as the Course Director, Co-Course Director, or Lecturer for several graduate-level classes. My primary teaching contribution at UNC has been the development of a graduate-level course called “Computational Modeling Laboratory”. This course provides both theoretical and practical instruction on how to develop meaningful quantitative models for biological systems. We focus specifically on how to choose and implement an appropriate modeling technique such as deterministic, stochastic, or inference-based approaches. The instruction is centered on a concrete biological system to which we can apply all of the course content. For example, last year we chose to model a well-studied calcium channel called the inositol trisphosphate receptor-channel. By becoming familiar with this cellular system, students learned how to determine the appropriate time scale for the model; choose a reasonable set of species; simulate ordinary differential equation-based and stochastic models; perform parameter fitting and sensitivity analysis; and understand the unique benefits of using machine learning or network inference-based approaches. Although the class draws on various mathematical concepts, it is designed so that students with no formal background in mathematics can still develop the intuition and skills necessary to construct computational models that are relevant to their thesis projects.