

Christine S. Cheng, Ph.D.

Associate Professor
J. Craig Venter Institute
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Academic Training:

- 3/2011 Ph.D. University of California, San Diego, Bioinformatics and Systems Biology
Thesis Advisor: Dr. Alexander Hoffmann
- 3/2001 M.S. Stanford University, Computer Science
- 6/1996 B.S. National Taiwan University, Plant Biology

Additional Training:

- 5/2011-8/2016 Post-Doctoral Training in epigenetics, transcriptomics, immunology,
bioinformatics, Laboratory of Aviv Regev
Broad Institute of MIT and Harvard, Cambridge, MA

Academic Appointments:

- 9/2016-7/2020 Assistant Professor, Department of Biology, Boston University
8/2020-present Associate Professor, J. Craig Venter Institute, La Jolla, CA

Participating Faculty Member:

- 2016-2020 Bioinformatics Program, Boston University
2017-2020 Transformative Training Program in Addiction Science, Boston University
2017-2020 Neurobiology group, Department of Biology, Boston University

Other Employment:

- 6/2001-6/2002 Business Analyst, McKinsey and Company, Business Technology
Office, Palo Alto, CA
6/2002-7/2003 Software Engineer, Oracle Corporation, Oracle Warehouse Builder,
Redwood City, CA

Awards and Honors:

- 2018-2020 Boston University Data Science Faculty Fellow
2012-2015 NIH L. Kirschstein NRSA Individual Postdoctoral Fellowship (F32)
2005-2008 DOD Army Breast Cancer Predoctoral Traineeship

Current Research Support

- 08/15/2018-05/31/2021 NIH/NIDA R61/R33 R61 DA047032MPI (Cheng contact PI,
Henderson M-PI), Effect of Opioid Use Disorder on HIV Latent
Reservoirs and Immune Dysfunction Assessed by Single-Cell.
Direct costs to Cheng lab: \$1,155,000 over 3 years

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- 06/01/2019-05/31/2021 NIH/NIDA/NIA Alzheimer's focused administrative supplements to awarded R61/R33 R61 DA047032MPI (Cheng PI), Single nuclei transcriptomics of Alzheimer's disease brain.
Direct cost to Cheng lab: \$250,000 over 2 years
- 06/01/2020-05/31/2021 NIH/NIDA COVID-19 focused administrative supplements to awarded R61/R33 R61 DA047032MPI (Cheng contact PI, Henderson MPI)
Direct cost to Cheng lab: \$100,000 over 1 year
- 09/01/2019-08/31/2021 Kilachand Fund for Integrated Life Science and Engineering, Boston University (Cheng and Wolozin M-PIs), Center for Synthetic Human Brain Studies.
Direct cost to Cheng lab: \$300,000 over 2 years
- 09/01/2020-08/31/2025 NIH NIDA UM1 (Cheng PI), Single cell transcriptomics of the opioid use disorder and HIV syndemic in the human brain.
Direct cost to Cheng lab: \$2,382,998 over 5 years
- 09/01/2020-06/30/2025 NIH NIDA U01 (Bryant PI, Cheng Co-PI), A reduced complexity cross in BALB/c substrains to identify the genetic basis of oxycodone dependence phenotypes.
Direct cost to Cheng lab: \$915,624 over 5 years
- 07/15/2020-04/30/2025 NIH NIDA R01 (Gummuluru contact PI, Cheng MPI, Mostoslavsky MPI), Synergistic Mechanisms of chronic Innate Immune Activation in Microglia by Opiates and HIV Infection.
Direct cost to Cheng lab: \$1,000,839 over 5 years

Past Research Funding Support

- 09/01/2018-06/30/2020 Boston University Data Science Faculty Fellow (Cheng PI)
Direct cost to my lab: \$50,000 over 2 years
- 04/01/2012-03/31/2015 NIH/NCI F32 CA168253: Cheng PI, Mapping the transcriptional regulatory circuits of human hematopoiesis, \$149,610 total cost

Original, Peer Reviewed Articles (*Co-first authors; ^δCorresponding authors):

Publications in preparation or in review process

1. Gok B*, O'Neill N*, Rickner H, Wolozin B, **Cheng CS^δ**. Single nuclei transcriptomics of Alzheimer's disease human brain. In preparation.
2. Rickner H*, Jian L*, Hong R, Gok B, Wolozin B^δ, **Cheng CS^δ**. A novel 3D organoid model for taupathy. In preparation.

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3. Cleary JP, Karagiannis T, O'Neill N, Richner H, Gok B, Hong R, Bannon M, **Cheng CS^δ**. A single cell atlas of nucleus accumbens from individuals with opioid usage reveals cell type specific transcriptional responses. In preparation.

Publications

1. Karagiannis T*, Cleary JP*, Gok B, Martin NG, Nelson EC, Yajima M, **Cheng CS^δ**. Single cell transcriptomics reveals opioid usage evokes widespread suppression of antiviral gene program. **Nature Communications** **2020** 11, 2611 (2020). (<https://www.nature.com/articles/s41467-020-16159-y>)
2. Rickner HD, Niu S-Y, **Cheng CS^δ**. An ATAC-seq Assay with Low Mitochondrial DNA Contamination from Primary Human CD4+ T Lymphocytes. **J Vis Exp.** **2019** Mar 22;(145). PMID: 3095873
3. Gate RE*, **Cheng CS*^δ**, Aiden AP, Siba A, Tabaka M, Lituiev D, Machol I, Gordon MG, Subramaniam M, Shamim M, Hougen KL, Wortman I, Huang SC, Durand NC, Feng T, DeJager PL, Chang HY, Aiden EL, Benoist C, Beer MA, Ye CJ^δ, Regev A^δ. Genetic determinants of co-accessible chromatin regions in activated T cells across humans. **Nature genetics.** **2018**; 50(8):1140-1150. PMID: 29988122
4. Quinodoz SA, Ollikainen N, Tabak B, Palla A, Schmidt JM, Detmar E, Lai MM, Shishkin AA, Bhat P, Takei Y, Trinh V, Aznauryan E, Russell P, **Cheng CS**, Jovanovic M, Chow A, Cai L, McDonel P, Garber M, Guttman M. Higher-Order Inter-chromosomal Hubs Shape 3D Genome Organization in the Nucleus. **Cell.** **2018** Jul 26;174(3):744-757. PMID: PMC6548320
5. Ji Z, He L, Rotem A, Janzer A, **Cheng CS**, Regev A, Struhl K. Genome-scale identification of transcription factors that mediate an inflammatory network during breast cellular transformation. **Nature communications.** **2018**; 9(1):2068. PMID: 29802342
6. Soto-Feliciano YM, Bartlebaugh JME, Liu Y, Sánchez-Rivera FJ, Bhutkar A, Weintraub AS, Buenrostro JD, **Cheng CS**, Regev A, Jacks TE, Young RA, Hemann MT. PHF6 regulates phenotypic plasticity through chromatin organization within lineage-specific genes. **Genes & development.** **2017**; 31(10):973-989. PMID: 28607179
7. Fiziev P, Akdemir KC, Miller JP, Keung EZ, Samant NS, Sharma S, Natale CA, Terranova CJ, Maitituoheti M, Amin SB, Martinez-Ledesma E, Dhamdhare M, Axelrad JB, Shah A, **Cheng CS**, Mahadeshwar H, Seth S, Barton MC, Protopopov A, Tsai KY, Davies MA, Garcia BA, Amit I, Chin L, Ernst J, Rai K. Systematic Epigenomic Analysis Reveals Chromatin States Associated with Melanoma Progression. **Cell reports.** **2017**; 19(4):875-889. PMID: 28445736
8. **Cheng CS***, Behar MS*, Suryawanshi GW, Feldman KE, Spreafico R, Hoffmann A. Iterative Modeling Reveals Evidence of Sequential Transcriptional Control Mechanisms. **Cell systems.** **2017**; 4(3):330-343.e5. PMID: 28237795

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9. Sanjana NE, Wright J, Zheng K, Shalem O, Fontanillas P, Joung J, **Cheng CS**, Regev A, Zhang F. High-resolution interrogation of functional elements in the noncoding genome. **Science**. **2016**; 353(6307):1545-1549. PMID: 27708104
10. **Cheng CS**, Rai K, Garber M, Hollinger A, Robbins D, Anderson S, Macbeth A, Tzou A, Carneiro MO, Raychowdhury R, Russ C, Hacohen N, Gershenwald JE, Lennon N, Nusbaum C, Chin L, Regev A, Amit I. Semiconductor-based DNA sequencing of histone modification states. **Nature communications**. **2013**; 4:2672. PMID: 24157732
11. Garber M, Yosef N, Goren A, Raychowdhury R, Thielke A, Guttman M, Robinson J, Minie B, Chevrier N, Itzhaki Z, Blecher-Gonen R, Bornstein C, Amann-Zalcenstein D, Weiner A, Friedrich D, Meldrim J, Ram O, **Cheng CS**, Gnirke A, Fisher S, Friedman N, Wong B, Bernstein BE, Nusbaum C, Hacohen N, Regev A, Amit I. A high-throughput chromatin immunoprecipitation approach reveals principles of dynamic gene regulation in mammals. **Molecular cell**. **2012**; 47(5):810-22. PMID: 22940246
12. Escoubet-Lozach L, Benner C, Kaikkonen MU, Lozach J, Heinz S, Spann NJ, Crotti A, Stender J, Ghisletti S, Reichart D, **Cheng CS**, Luna R, Ludka C, Sasik R, Garcia-Bassets I, Hoffmann A, Subramaniam S, Hardiman G, Rosenfeld MG, Glass CK. Mechanisms establishing TLR4-responsive activation states of inflammatory response genes. **PLoS genetics**. **2011**; 7(12):e1002401. PMID: 22174696
13. **Cheng CS**, Feldman KE, Lee J, Verma S, Huang DB, Huynh K, Chang M, Ponomarenko JV, Sun SC, Benedict CA, Ghosh G, Hoffmann A. The specificity of innate immune responses is enforced by repression of interferon response elements by NF- κ B p50. **Science signaling**. **2011**; 4(161):ra11. PMID: 21343618
14. Ramirez-Carrozzi VR, Braas D, Bhatt DM, **Cheng CS**, Hong C, Doty KR, Black JC, Hoffmann A, Carey M, Smale ST. A unifying model for the selective regulation of inducible transcription by CpG islands and nucleosome remodeling. *Cell*. 2009; 138(1):114-28. PMID: 19596239
15. **Cheng CS**, Johnson TL, Hoffmann A. Epigenetic control: slow and global, nimble and local. **Genes & development**. **2008**; 22(9):1110-4. PMID: 18451102
16. Kwon YS, Garcia-Bassets I, Hutt KR, **Cheng CS**, Jin M, Liu D, Benner C, Wang D, Ye Z, Bibikova M, Fan JB, Duan L, Glass CK, Rosenfeld MG, Fu XD. Sensitive ChIP-DSL technology reveals an extensive estrogen receptor alpha-binding program on human gene promoters. **Proceedings of the National Academy of Sciences of the United States of America**. **2007**; 104(12):4852-7. PMID: 17360330
17. Garcia-Bassets I, Kwon YS, Telese F, Prefontaine GG, Hutt KR, **Cheng CS**, Ju BG, Ohgi KA, Wang J, Escoubet-Lozach L, Rose DW, Glass CK, Fu XD, Rosenfeld MG. Histone methylation-dependent mechanisms impose ligand dependency for gene activation by nuclear receptors. **Cell**. **2007**; 128(3):505-518. PMID: 17289570

Teaching Experience and Responsibilities:

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- 9/2017-present Developed and sole instructor for graduate course BI577 “Quantitative Approaches in Molecular Biology” (26 lectures, 52 hours)
1/2017-present Co-developed and co-instructor for undergraduate course BB522 “Molecular Biology Laboratory” (14 lectures, 49 hours)

Trainees supervised:

Ph.D. students

- 6/2017-present Patrick Cleary (Molecular Biology, Cell Biology & Biochemistry Program)
6/2018-present Nick O’Neill (Bioinformatics Program)
6/2018-present Hannah Rickner (Cell & Molecular Biology)
6/2018-present Busra Gok (Cell & Molecular Biology)
6/2017-1/2020 Tanya Karagiannis (Bioinformatics Program)

M.S. students

- 4/2018-present Junpei Xiao (Bioinformatics)

Undergraduate students

- 05/2019-present Amy Wu (Biology)
9/2018-06/2019 Jason Li (Computer Science and Biology)
9/2018-present Anya Pandit (Biomedical Engineering)
1/2017-07/2018 Sheng-Yong Simon Niu (Biochemical Science and Technology, NTU)
(Current position: graduate student, Department of Computer Science and Engineering, University of California, San Diego)

Invited Lectures and Conference Presentations

- 2019 Scripps Institute
2019 Sanford Burnham Prebys Medical Discovery Institute
2019 5th Annual Single Cell Analysis USA Congress, Oxford Global Conference
2018 Boston University, Medical School, Research on TAP, single cell sequencing
2018 Boston University, BU Data Science Day
2018 NIH NIDA Genetics Consortium Meeting
2017 Boston University, Medical School, Microbial Pathogenesis, Inflammation and Immunology Seminar
2016 National Taiwan University, Medical School, Taiwan
2016 Academic Sinica, Taiwan
2016 Cold Spring Harbor Epigenetic and Chromatin Meeting
2016 Cell Circuits and Epigenomics Program Meeting, Broad Institute of MIT and Harvard
2016 Medical and Population Genomics Meeting, Broad Institute of MIT and Harvard
2016 New Initiative in Precision Medicine, Epigenetics and Genomics, School of Medicine, University of California, San Diego
2016 Department of Immunology, UT Southwestern
2016 Department of Pharmaceutical Chemistry, University of California, San Francisco
2016 Department of Biology, Boston University

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- 2015 Department of Biomedical Engineering, Johns Hopkins University
- 2015 Klarman Cell Observatory Annual Retreat, Broad Institute of MIT and Harvard
- 2010 Keytone NFkB in Inflammation and Disease Meeting

Professional Activities

- 01/2020 Reviewer for NIH NIDA Epigenomic and non-coding RNA regulation in chronic pain
- 12/2019 Reviewer for NIH NIDA American's startup and small businesses build technologies to stop opioid epidemic
- 11/2019 Reviewer for NIH NIDA Cutting-Edge Basic Research Awards (CEBRA)
- 10/2019 Reviewer for NIH NIDA Special Emphasis Review Panel: Exploiting omics assays to investigate molecular regulation of persistent HIV in individuals with substance use disorder
- 02/2019 Reviewer for NIH NIDA Special Emphasis Review Panel: Modeling HIV using cerebral organoid
- 09/2018 Reviewer for NIH NIDA Avant-Garde Award Program for HIV/AIDS and Drug Use research (DP1)
- 10/2018 Reviewer for NIH NIDA Cutting-Edge Basic Research Awards (CEBRA)

Ad hoc Reviewer for: Nucleic Acid Research, *BMC Molecular Biology*, *BMC Genomics*

Departmental and University Committees:

- 2016 Admissions Committee, Bioinformatics Graduate Program, Boston University
- 2016 Admissions Committee, Cell & Molecular Biology Graduate Program, Boston University