

Lacramioara Bintu

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Research Summary

My group studies the basic principles of **gene regulation** in human cells with a focus on: **transcription factors** (see: [new method to measure tens of thousands of regulators](#) and [combinations](#) in human cells, discovery of hundreds of [new human transcriptional activators and repressors and their sequence rules](#), [viral transcriptional activators and repressors](#)), **chromatin** (see: [spreading](#), [chromatin structure and memory](#), [oncohistones and memory](#)), and **RNA regulators** (see [high-throughput method to identify modular effector domains in RNA binding proteins](#)). We **use high-throughput synthetic biology, single-cell imaging, and mathematical modeling**. We build new tools to measure, perturb, and model gene regulation.

Education

2010	Ph.D. Physics <i>Dissertation:</i> Dynamic Interactions and Molecular Rearrangements Occurring when RNA Polymerase II Meets the Nucleosome	University of California, Berkeley
2005	B.S. Physics, Neuroscience, Mathematics, <i>summa cum laude</i> <i>Thesis:</i> Statistical Mechanics of Gene Regulation	Brandeis University

Employment History

2025-present	Associate Professor of Bioengineering, Stanford University, Member of the Bio-X and Biophysics Programs Direct research on genetic and epigenetic regulation and synthetic biology. Teach 2 courses/year.
2017-2025	Assistant Professor of Bioengineering, Stanford University
2011-2016	Postdoctoral Fellow, California Institute of Technology with <i>Prof. Michael Elowitz</i> Measured single-cell dynamics of gene expression in response to recruitment of chromatin regulators at a reporter gene, and developed a model of chromatin-mediated gene regulation.
2005-2010	Graduate Student, University of California, Berkeley with <i>Prof. Carlos Bustamante</i> Measured single-molecule transcription of RNA polymerase II through nucleosomes using optical tweezers and AFM, and developed models of transcription and histone transfer. Graduate Teaching Assistant: Molecular Biophysics, Physics for Scientists and Engineers
2004&2005 Summers	Research Assistant, California Institute of Technology with <i>Prof. Rob Phillips</i> Modeled how the mechanics of DNA looping between repressor binding sites influences transcriptional repression in the <i>lac</i> and <i>ara</i> operons.
2004-2005	Undergraduate Student Researcher, Brandeis University with <i>Prof. Jané Kondev</i> Developed a model of gene regulation at the level of transcription using the thermodynamics of polymerase and transcription factors binding to DNA in <i>Escherichia coli</i> .
2003	Research Assistant, Brandeis University with <i>Prof. Karl Canter</i> Studied the life cycle of multicellular magnetotactic prokaryotes using time-lapse microscopy.
2003	Instructor, Teaching Opportunities in Physical Sciences (TOPS) MIT & Harvard
2002	Undergraduate Teaching Assistant: Modern Physics, Brandeis University

Professional Experience

2025-present	Chair of Graduate Admission, Stanford Bioengineering PhD&MS Program
2022-present	Co-Founder and Scientific Advisor, Stylus Medicine
2021-present	Member, Genome Technology Development Working Group, NHGRI, NIH
2021-2025	Co-Chair of Imaging Working Group, 4D Nucleome, Common Fund, NIH
2021-2025	Member, Integrating Imaging and Omics Working Group, 4D Nucleome, NIH
2024	Conference Co-chair, EMBO: Quantitative biology to molecular mechanisms, Heidelberg, Germany

2024	Conference Co-chair: Keystone Single-Cell Biology: Tissue Genomics, Technologies and Disease, Vancouver, Canada
2021	Member of the Planning Committee for the 4D Nucleome NIH Annual Meeting
2020	Member, Grant Review Panel, National Institutes of Health
2019, 2022-24	Conference Organizer, International Mammalian Synthetic Biology Workshop
2018-2022	Conference Organizer: International Conference on Epigenetics and Bioengineering

Grants, Fellowships, and Awards

2018-2028	Maximizing Investigators' Research Award (MIRA) R35, NIGMS, NIH, Single-cell analysis and synthetic control of mammalian chromatin dynamics and gene regulation
2021-2025	R01 Award, NIH, NHGRI, High-throughput development and characterization of compact tools for transcriptional and chromatin perturbations, MPis: Bintu and Bassik
2020-2025	U01 Award, 4DN Common Fund, NIH, Live-cell multiplex super-resolution imaging of chromatin state transitions, MPis: Bintu and Boettiger; Co-Is: Greenleaf, Spakowitz, Wysocka
2015-2020	Career Award at the Scientific Interface, Borroughs Wellcome Fund
2011-2014	Jane Coffin Childs Postdoctoral Fellowship
2011-2014	Beckman Institute Fellowship, equipment research grant, California Institute of Technology
2011	Weintraub Graduate Student Award for outstanding achievement, Fred Hutchinson Center
2006	Outstanding Graduate Student Instructor Award, University of California, Berkeley
2005	Doris Brewer Cohen Endowment Award for best senior thesis, Brandeis University
2005	Molly W. and Charles K. Schiff Memorial Award in Science, Brandeis University
2004	Elihu A. Silver Prize for undergraduate research in science, Brandeis University
2001-2005	Wien International Scholarship, Brandeis University

Trainees

Current: 9 graduate students and 4 postdoctoral scholars

Past: 10 PhD students, 2 postdoctoral scholars, 2 postbacs (now in PhDs), 8 undergraduate students

Selected Publications

† Co-corresponding authors. * Equal-contributing first authors. My trainees are indicated in bold face.

1. **Thurm AR, Finkel Y, Andrews C, Cai XS**, Benko C, **Bintu L**. High-throughput mapping of modular regulatory domains in human RNA-binding proteins. *Cell Systems*. 2026 Jan 21;17(1).
2. Wolfsberg E, Paul JS, **Tycko J**, Chen B, Bassik MC, **Bintu L**, Alizadeh AA, Gao XJ. Machine-guided dual-objective protein engineering for deimmunization and therapeutic functions. *Cell Systems*. 2025 Jun 3.
3. Heller EA, **Bintu L**, Rots MG. Epigenetic editing: from concept to clinic. *Nature Reviews Drug Discovery*. 2025 Nov 24:1-22.
4. **Thurm AR, Janer Carattini GL, Bintu L**. Human Synthetic Biology and Programmable Gene Regulation Control. *Annual Review of Genomics and Human Genetics*. 2025 Apr 25;26.
5. Doughty BR*, **Hinks MM***, Schaepe JM*, Marinov GK, **Thurm AR, Rios-Martinez C**, Parks BE, Tan Y, Marklund E, Dubocanin D, **Bintu L**†, Greenleaf WJ†. Single-molecule chromatin configurations link transcription factor binding to expression in human cells. *Nature*. Epub Nov 20, 2024
6. **Tycko J***, **Van M***, Aradhana, **DelRosso N**, Yao D, Xu X, **Ludwig C**, Spees K, Liu K, Hess GT, Gu M., **Mukund AX, Suzuki PH**, Kamber RA, Qi LS, **Bintu L**†, Bassik MC†. Development of compact transcriptional effectors using high-throughput measurements in diverse contexts. *Nature Biotechnology*, doi: 10.1038/s41587-024-02442-6 Epub Nov 1 2024.
7. **Sinha J, Nickels JF, Thurm AR, Ludwig CH**, Archibald BN, **Hinks MM, Wan J**, Fang D, **Bintu L**. The H3.3 K36M oncohistone disrupts the establishment of epigenetic memory through loss of DNA methylation, *Molecular Cell* 84(20):3899-3915, 2024

8. **Mukund AX, Tycko J, Allen SJ**, Robinson SA, Andrews C, **Ludwig CH**, Spees K, Bassik MC, **Bintu L**. High-throughput functional characterization of combinations of transcriptional activators and repressors. *Cell Systems*, 14(9):746–763, 2023
9. **Ludwig CH, Thurm AR**, Morgens DW, Yang KJ, **Tycko J**, Bassik MC, Glaunsinger BA, **Bintu L**. High-Throughput Discovery and Characterization of Viral Transcriptional Effectors in Human Cells, *Cell Systems*, 14(6):482-500, 2023
10. **DelRosso N, Tycko J, Suzuki P, Andrews C**, Aradhana, **Mukund A, Liongson I, Ludwig C**, Spees K, Fordyce P, Bassik MC, **Bintu L**. Large-scale mapping and mutagenesis of human transcriptional effector domains. *Nature*. Apr;616(7956):365-372, 2023
11. Dekker J, Alber F, Aufmkolk S, Beliveau BJ, Bruneau BG, Belmont AS, **Bintu L**, Boettiger A, Calandrelli R, Disteché CM, Gilbert DM, Gregor T, Hansen AS, Huang B, Huangfu D, Kalhor R, Leslie CS, Li W, Li Y, Ma J, William S. Noble WS, Peter J. Park PJ, Jennifer E. Phillips-Cremens JE, Katherine S. Pollard KS, Rafelski SM, Ren B, Ruan Y, Shav-Tal Y, Shen Y, Shendure K, Shu X, Strambio-De-Castillia C, Vertii A, Zhang H, Zhong S "Spatial and temporal organization of the genome: current state and future aims of the 4D Nucleome Project," *Molecular Cell* 83, 2023
12. **Hinks M**, Marinov GK, Kundaje A, **Bintu L**, Greenleaf WJ. "Single-Molecule Mapping of Chromatin Accessibility Using NOME-seq/dSMF." *Methods Mol Biol*. 2611:101-119, 2023
13. Cabera A*, Edelstein HI*, Glykofrydis F*, Love KS*, Palacios S*, **Tycko J***, Zhang M, **Lensch S**, Shields CE, Livingston M, Weiss R, Zhao H, Haynes KA, Morsut L, Chen YY, Khalil AS, Wong WW, Collins JJ, Rosser SJ, Polizzi K, Elowitz MB, Fussenegger M, Hilton IB, Leonard JN, **Bintu L**, Galloway KE, Deans TL. "The sound of silence: Transgene silencing in mammalian cell engineering." *Cell Systems* 13(12): 950-973, 2022.
14. Durrant MG*, Fanton A*, **Tycko J***, **Hinks MM**, Chandrasekaran SS, Perry NT, Schaepe J, Du PP, Lotfy P, Bassik MC†, **Bintu L†**, Bhatt AS†, Hsu PD†. "Systematic discovery of recombinases for efficient integration of large DNA sequences into the human genome," *Nature Biotech.*, Apr;41(4):488-499, 2023
15. **Lensch S, Herschl MH, Ludwig CH, Sinha J, Hinks MM, Mukund A, Fujimori T, Bintu L**. "Dynamic spreading of chromatin-mediated gene silencing and reactivation between neighboring genes in single cells," *eLife* 11:75115, 2022
16. **Mukund A, Bintu L**, "Temporal signaling, population control, and information processing through chromatin-mediated gene regulation," *Journal of Theoretical Biology* 535, 110977, ISSN 0022-5193, 2022
17. **Van MV, Fujimori T, Bintu L**, "Nanobody-mediated control of gene expression and epigenetic memory," *Nature Communications*, 12(1): 1-12, 2021
18. **Tycko J, DelRosso N**, Hess GT, Aradhana, Banerjee A, **Mukund A, Van MV**, Ego BK, Yao D, Spees K, **Suzuki P**, Marinov GK, Kundaje A, Bassik MC†, **Bintu L†**, "High-throughput discovery and characterization of human transcriptional effectors," *Cell*, 183(7): 2020-2035.e16, 2020
19. **Tycko J***, Wainberg M*, Marinov GK*, Ursu O, Hess GT, Ego BK, Aradhana, Li A, Truong A, Trevino AE, Spees K, Yao D, Kaplow IM, Greenside PG, Morgens DW, Phanstiel DH, Snyder MP, **Bintu L**, Greenleaf WJ, Kundaje A, Bassik MC, "Mitigation of off-target toxicity in CRISPR-Cas9 screens for essential non-coding elements", *Nature Communications*, 10(1): 1-14, 2019
20. **Ludwig CH, Bintu L**, "Mapping chromatin modifications at the single-cell level." *Development*, 146(12): dev170217, 2019
21. **Tycko J***, **Van MV***, Elowitz MB, & **Bintu L**, "Advancing towards a global mammalian gene regulation model through single-cell analysis and synthetic biology," *Current Opinion in Biomedical Engineering*, 4: 174-193, 2017
22. **Bintu L***, Yong J*, Antebi YE, McCue K, Kazuki Y, Uno N, Oshimura M, Elowitz MB, "Dynamics of epigenetic regulation at the single-cell level," *Science*, 351 (6274): 720-724, 2016
23. **Bintu L***, Ishibashi T*, Dangkulwanich M, Wu Y, Lubkowska L, Kashlev M, Bustamante C, Nucleosomal Elements that Control the Topography of the Barrier to Transcription. *Cell*, 151 (4): 738 (2012).
24. Zamft B, **Bintu L**, Ishibashi T, Bustamante C. Nascent RNA Structure Modulates the Transcriptional Dynamics of RNA Polymerases. *Proceedings of the National Academy of Sciences*, 109 (23): 8948-8953, 2012.

25. **Bintu L***, Kopaczynska M*, Hodges C, Lubkowska L, Kashlev M, Bustamante C. The Elongation Rate of RNA Polymerase Determines the Fate of Transcribed Nucleosomes. *Nature Structural & Molecular Biology*, 18 (12): 1394-1399, 2011.
26. Hodges C*, **Bintu L***, Lubkowska L, Kashlev M, Bustamante C. Nucleosomal Fluctuations Govern the Transcription Dynamics of RNA Polymerase II. *Science*, 325 (5940): 626, 2009.
27. **Bintu L**, Buchler N, Garcia H, Gerland U, Hwa T, Kondev J, Phillips R. Transcriptional Regulation by the Numbers 1: Models. *Current Opinion in Genetics & Development*, 15(2):116, 2005.

Edited Works:

DelRosso N, Bintu L, Using High-Throughput Measurements to Identify Principles of Transcriptional and Epigenetic Regulators. Book chapter in *Epigenome Editing: Methods and Protocols* (pp. 79-101). New York, NY: Springer US, 2024.

Selected Preprints

1. **Thurm AR**, Nguyen TH, Torres Campos JD, Mansfield M, **Bintu L**, Hagler LD. Structural probing of RNA hairpins quantifies protein occupancy on RNA and links it to function in human cells. bioRxiv. 2026:2026-01. <https://doi.org/10.64898/2026.01.06.698062>
2. **Andrews CJ, Costa EJ, Janer Carattini GL, DelRosso NV, Fujimori T, Shimasawa M, Bintu L**. Bifunctional transcriptional effector domains control gene expression pulses in an occupancy-dependent manner. bioRxiv. 2025 Dec 12:2025-12. <https://doi.org/10.64898/2025.12.10.693551>
3. **Wan J***, **Thurm AR***, **Allen SJ**, **Ludwig CH**, **Patel AN**, **Bintu L**. High-throughput development and characterization of new functional nanobodies for gene regulation and epigenetic control in human cells. BioRxiv 2024. <https://doi.org/10.1101/2024.11.01.621523>
4. Valbuena R*, Nigam A*, **Tycko J**, **Suzuki P**, Spees K, Aradhana A, Arana S, Du P, Patel RA, **Bintu L**†, Kundaje A†, Bassik MC†. Prediction and design of transcriptional repressor domains with large-scale mutational scans and deep learning. BioRxiv 2024. <https://doi.org/10.1101/2024.09.21.614253>
5. **DelRosso N***, **Suzuki PH***, Griffith D, Lotthammer JM, Novak B, Kocalar S, Sheth MU, Holehouse AS, **Bintu L**†, Fordyce P†. High-throughput affinity measurements of direct interactions between activation domains and co-activators. BioRxiv 2024. <https://doi.org/10.1101/2024.08.19.608698>
6. **Fujimori T**, **Rios-Martinez C**, **Thurm AR**, **Hinks MM**, Doughty BR, **Sinha J**, Le D, Hafner A, Greenleaf WJ, Boettiger AN, **Bintu L**. Single-cell chromatin state transitions during epigenetic memory formation, BioRxiv 2023 <https://doi.org/10.1101/2023.10.03.560616>

Patents

1. DelRosso NV, Mukund AX, Suzuki P, Tycko J, Bassik MC, Bintu L. 2023. Compositions for activating and silencing gene expression, WO2023173012A2, Application filing
2. Bhatt AS, Durrant MG, Tycko JC, Hsu PD, Fanton A, Bassik MC, Bintu L. 2021. Serine Recombinases. US20240417754A1, Pending
3. Bintu L, Van M, Wan J. 2021. Nanobodies Against Endogenous Chromatin Regulators for Transcriptional and Epigenetic Control in Human Cells. 2021. WO2023039528A1, Application filing
4. Bassik MC, Tycko J, Hess GT, and Bintu L. Compositions, Systems, and Methods for The Generation, Identification, and Characterization of Effector Domains for Activating and Silencing Gene Expression. 2020. US20240401032A1, Pending
5. Bintu L, Yong J, Elowitz ME. 2016. Fractional Regulation of Transcription. US20160304872A1

Selected Presentations

Invited Plenary Talks and Distinguished Lectures

1. Keynote Speaker: Systems Biology of Single Cells Conference, Irvine, CA, May 8-9, 2025.
2. Keynote Speaker: American Physical Society Global Physics Summit, Genome Organization Session, Anaheim, CA, March 16-21, 2025
3. Keynote Speaker: Integrative Training Symposium, North Carolina State University, Raleigh, NC, Feb. 9,

2024

4. Rising Stars Dahlem Colloquia in Molecular Genetics, Max Planck Institute, Berlin, Germany, Nov. 14, 2022
5. Keynote Speaker: University of California Berkeley Biophysics Retreat, Santa Cruz, CA, Oct 1, 2022

Invited Presentations at International Conferences

1. Genome Regulatory Code Consortium (GRCC) Meeting: Solving the human cis-regulatory code workshop, Toronto, Canada, November 4 – 7, 2025
2. Cold Spring Harbor Laboratory (CSHL) International Conference: Mechanisms of Eukaryotic Transcription, Cold Spring Harbor, NY, August 26-30, 2025
3. International Mammalian Synthetic Biology Workshop (mSBW), Irvine, CA, USA, August 11-12, 2025
4. European Molecular Biology Organization (EMBO) International Conference: Gene regulation: one molecule at a time, Heidelberg, Germany, July 15-18, 2025
5. Gordon Research Conference: Genome Architecture in Cell Fate and Disease, Ventura Beach, CA, June 15-20, 2025
6. Keystone Symposia on Epigenetics in Development and Disease / Interplay of Chromatin Architecture and Transcription Regulation. Banff, Canada, March 29- April 2, 2025
7. EMBO: Quantitative biology to molecular mechanisms, Heidelberg, Germany, November 19 – 22, 2024
8. International Epigenetics and Bioengineering Conference, Amsterdam, Netherlands, Oct. 3-5, 2024
9. Single-Cell Genomics International Conference, Corinthia, Greece, September 16-18, 2024
10. Gordon Research Conference: Chromatin Structure and Function, Smithfield, RI, July 7-12, 2024
11. 15th International Conference on Genomics and Systems Biology of Human Disease and Aging, Chania, Greece, June 22-26, 2024
12. CSHL: Systems Biology: Global Regulation of Gene Expression, Cold Spring Harbor, NY, Mar.13-16, 2024
13. Winter qBio, Oahu, Hawaii, February 19-23, 2024
14. Biophysical Society Meeting, Philadelphia, PA, February 12-13, 2024
15. Keystone Single-Cell Conference, Vancouver, BC, Canada, January 21-24, 2024
16. Rules of Protein-DNA Recognition International Conference, Cancun, Mexico, Oct 10-13, 2023
17. Cell Press: The Conceptual Power of Single-cell Biology, San Diego, CA, USA, Aug 28-30, 2023
18. Synthetic Biology Gordon Research Conference: Transforming Biology into a Technology to Solve Global Challenges, Newry, ME, USA, July 16-21, 2023
19. Synthetic Biology: Engineering, Evolution & Design (SEED), Los Angeles, CA, USA, May 31-June 1, 2023
20. European Laboratory Research & Innovation Group, Research and Innovation 2023 – Accelerating Future Drug Discovery, Wellcome Trust Sanger Institute, Cambridge, UK, March 29-30, 2023
21. 5th International Conference on CRISPR Technologies, Claremont, CA, USA, Oct. 31-Nov. 2, 2022
22. Learning Meaningful Representations of Life Workshop, Thirty-fifth Conference on Neural Information Processing Systems (NeurIPS), virtual, December 14, 2021

NIH Conferences

1. Advances in Genomic Technology Development Annual Meeting, Farmington, CT, June 11-13, 2024
2. 4D Nucleome Consortium NIH Annual Meeting, Imaging-Sequencing FISH-OMICS Data Formats and Standards, Boston, MA, Dec 9-11, 2023

Department Seminars

1. University of California San Francisco, Basic Science Seminar Series, San Francisco, CA, May 20, 2025
2. University of Chicago Institute of Biophysical Dynamics Seminar Series, Chicago, IL, Jan. 21, 2025
3. California Institute of Technology, Biology and Bioengineering Seminar, Pasadena, CA Oct. 22, 2024

4. Stanford Frontiers in Biology Seminar Series, Stanford, CA, May 8, 2024
5. Broad Institute of MIT and Harvard Seminar, Cambridge, MA, Dec 8, 2023
6. MIT Biology and Whitehead Institute Seminar, Cambridge, MA, Dec 7, 2023
7. Harvard Medical School, Systems Biology Department Seminar, Boston, MA, Dec 4, 2023
8. Genentech, Translational Genomics Speaker Seminar, San Francisco, CA, USA, September 19, 2023
9. Washington University in Saint Louis, Genetics Department Seminar, St. Louis, MO, USA, May 23, 2023
10. University of California Berkeley, Molecular and Cellular Biology Department Seminar, Berkeley, CA, USA, May 5, 2023
11. Vienna BioCenter Seminar, Vienna, Austria, November 19, 2022