Stanford

Livnat Jerby

Assistant Professor of Genetics

Bio

BIO

Dr. Jerby is an Assistant Professor in the Department of Genetics at Stanford University, an Allen Distinguished Investigator, and a Chan Zuckerberg Biohub Investigator. Intrigued and inspired by the way the immune system works (while also recognizing its limitations), her research group aims to decode and augment mechanisms that have evolved for millions of years with mechanisms that they “evolve” and rationally design in the lab to target malignant and premalignant cells. Building upon her multidisciplinary expertise, her group combines advanced genetic tools with high-content, high-throughput readouts, AI/data-driven experimental design, cell engineering, synthetic biology, and directed evolution to scan large combinatorial search spaces, optimize cell functions of interest, and identify nonlinear interactions to obtain precise and targeted interventions. In line with this, they have also been at the forefront of studying tumor immunology directly in patients by applying emerging technologies to large patient populations.

Recent work from her laboratory identified programmable mechanisms to redirect T cells and Natural Killer (NK) cells to solid tumors – providing a potential basis for “spatially targeted cell therapies”, identified novel regulators and RNA-based interventions that selectively sensitize cancer and virally infected cells to immune-based elimination, developed new technologies to track the impact of genetic perturbations in the intact tissue, and mapped tumor organization at unprecedented scales.

Dr. Jerby holds a BSc, MSc, and PhD in life sciences and Computer Science (CS) from Tel Aviv University and conducted her postdoctoral research at the Broad Institute of MIT and Harvard in Dr. Aviv Regev’s laboratory. She is the recipient of numerous awards, including the Burroughs Wellcome Fund (BWF) Career Award at the Scientific Interface (CASI), the Ovarian Cancer Research Alliance (OCRA) Liz Tilberis Early Career Award, Chan Zuckerberg Biohub Investigator Award, Paul G. Allen Distinguished Investigator Award, Stanford Cancer Institute Innovation Awards, awards from the Bill and Melinda Gates Foundation, Marsha Rivkin Center for Ovarian Cancer, Basser Center, Cancer Research Institute (CRI), Schmidt Family Foundation, Dan David Foundation, Rothschild Foundation, Stanford Innovative Medicines Accelerator (IMA), the National Institute of Health (NIH), and the Department of Defense (DOD).

ACADEMIC APPOINTMENTS

- Assistant Professor, Genetics
- Member, Bio-X
- Member, Stanford Cancer Institute

HONORS AND AWARDS

- Alba Tull Molecular Therapeutics Award for Innovative Medicines, Tull Family Foundation (2025 - 2026)

- Allen Distinguished Investigator, Paul G. Allen Family Foundation (2022 - 2025)
- Liz Tilberis Early Career Award, Ovarian Cancer Research Alliance (2022 - 2025)
- Investigator award, Chan Zuckerberg biohub (2020 - 2025)
- Career Awards at the Scientific Interface (CASI), Burroughs Wellcome Fund (BWF) (2019 - 2024)
- Postdoctoral training fellowship, Cancer Research Institute (CRI) (2016-2019)
- Postdoctoral award, Eric and Wendy Schmidt Foundation (2016-2017)
- Postdoctoral fellowship, Rothschild, Yad Hanadiv (2015-2016)

PATENTS

- Aviv Regev, Pratiksha Thakore, John Doench, JT Neal, Jesse Boehm, Oana Ursu, Livnat Jerby-Arnon. "United States Patent 16/809,458 Methods and Compositions for Massively Parallel Variant and Small Molecule Phenotyping"
- Aviv Regev, Livnat Jerby-Arnon, Ana Anderson, Katherine Tooley, Vijay K. Kuchroo. "United States Patent 17/083,235 Pan-Cancer T Cell Exhaustion Genes"
- A. Regev, O. Rozenblatt-Rosen, B. Izar, and L. Jerby. "United States Patent PCT/US2018/054020 and PCT/US2018/025507 Methods and compositions for detecting and modulating an immunotherapy resistance gene signature in cancer"
- Livnat Jerby, A. Regev, L. Jerby, M. Suva, N. Riggi. "United States Patent PCT/US2020/022466 Detection means, Compositions and Methods for Modulating Synovial Sarcoma Cells"
- L Jerby, RV Akana. "United States Patent PCT/US2025/030855 Selective sensitization of cancer cells to elimination by cytotoxic lymphocytes", The Board of Trustees of the Leland Stanford Junior University, May 24, 2024
- L Jerby, YM Kim. "United States Patent PCT/US2025/023673 Engineering immune cells to migrate to, infiltrate, persist, and expand in solid tumors", The Board of Trustees of the Leland Stanford Junior University, Apr 8, 2024

LINKS

- Lab website: http://jerbylab.stanford.edu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The immune system has a remarkable ability to distinguish between healthy (self) and unhealthy (non/altered self) cells and eliminate only the latter. This process can depend on a single cell or millions of cells that transmit information to one another.

OUR GOAL: Inspired by the way the immune system works, we aim to decode, rewire, and develop new and effective mechanisms to selectively eliminate and reprogram “altered self” disease-causing cells (as cancer, senescent, virally infected, and other dysfunctional cells) for disease treatment and prevention.

OUR APPROACH: Our work is at the interface between cell engineering, synthetic biology, functional genomics, machine learning, and immunology. We integrate in-silico/ex-vivo/in-vivo systems to probe, track, and redirect complex biological processes across scales. Using genetic perturbations with high-content, high-throughput readouts, AI/data-driven experimental design, and directed evolution we perform multiplexed experiments and scan large combinatorial search spaces to (1) rapidly optimize different cell functions of interest, (2) identify non-linear interactions to obtain precise and targeted interventions with desired context-specific effects, and (3) decode and integrate mechanisms that have evolved for millions of years with mechanisms that we “evolve” and rationally design in the lab.

OUR DISCOVERIES: We recently identified programmable mechanisms to engineer T cells and Natural Killer (NK) to redirect these lymphocytes into solid tumors (providing a basis for spatially targeted cell therapies), identified RNA-based interventions that selectively sensitize cancer and virally

infected cells to immune-based elimination (selectively eliminating these harmful cells without harming healthy ones), developed new technologies to track the impact of genetic perturbations in the intact tissue, and mapped tumor organization at unprecedented scales.

Teaching

COURSES

2025-26

- Genomics: GENE 211 (Win)

2024-25

- Genomics: GENE 211 (Win)

2023-24

- Genomics: GENE 211 (Win)

2022-23

- Biology and Applications of CRISPR/Cas9: Genome Editing and Epigenome Modifications: BIOS 268, GENE 268 (Spr)
- Genomics: GENE 211 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Alvina Adimoelja, Christie Chang, Peter Du, Rachel Gleyzer, Matt Grieshop, Kathryn Hanson, Jessica Kain, Marcos Labrado, Yujung Park, Natalie Pilla, Emily Shen, Arianna Silva-Torres, Brennan Simon, George Wythes

Doctoral Dissertation Advisor (AC)

Celeste Diaz, Kristen Frombach, Mike Tsai, Christine Yiwen Yeh

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Genetics (Phd Program)

Publications

PUBLICATIONS

- **High-content CRISPR activation screens identify synthetically lethal RNA-based mechanisms to sensitize cancer cells to targeted T cell cytotoxicity.** *Nature genetics*
  Akana, R. V., Yoe, J., Laveroni, O., Sun, C., Kim, Y. M., Jerby, L.
  2026
- **Engineering NK and T cells with metabolite-sensing receptors to target solid tumors.** *Nature immunology*
  Kim, Y. M., Tsai, M. K., Sun, C., Laveroni, O., Akana, R. V., Frombach, K., Jerby, L.
  2026
- **Mapping spatial organization and genetic cell-state regulators to target immune evasion in ovarian cancer.** *Nature immunology*
  Yeh, C. Y., Aguirre, K., Laveroni, O., Kim, S., Wang, A., Liang, B., Zhang, X., Han, L. M., Valbuena, R., Bassik, M. C., Kim, Y. M., Plevritis, S. K., Snyder, et al
  2024
- **DIALOGUE maps multicellular programs in tissue from single-cell or spatial transcriptomics data.** *Nature biotechnology*
  Jerby-Arnon, L., Regev, A.
  2022
- **Opposing immune and genetic mechanisms shape oncogenic programs in synovial sarcoma.** *Nature medicine*

Jerby-Arnon, L. n., Neftel, C. n., Shore, M. E., Weisman, H. R., Mathewson, N. D., McBride, M. J., Haas, B. n., Izar, B. n., Volorio, A. n., Boulay, G. n., Cironi, L. n., Richman, A. R., Broye, et al

2021

- **A Cancer Cell Program Promotes T Cell Exclusion and Resistance to Checkpoint Blockade.** *Cell*

  Jerby-Arnon, L., Shah, P., Cuoco, M. S., Rodman, C., Su, M. J., Melms, J. C., Leeson, R., Kanodia, A., Mei, S., Lin, J. R., Wang, S., Rabasha, B., Liu, et al

  2018; 175 (4): 984-997.e24

- **Predicting Cancer-Specific Vulnerability via Data-Driven Detection of Synthetic Lethality** *CELL*

  Jerby-Arnon, L., Pfetzer, N., Waldman, Y. Y., McGarry, L., James, D., Shanks, E., Seashore-Ludlow, B., Weinstock, A., Geiger, T., Clemons, P. A., Gottlieb, E., Ruppin, E.

  2014; 158 (5): 1199–1209

- **High content CRISPR activation screens identified synthetically lethal RNA-based mechanisms to sensitize cancer cells to targeted T cell cytotoxicity.**

  Yoe, J., Akana, R. V., Laveroni, O., Sun, C., Kim, Y., Jerby, L.

  AMER ASSOC CANCER RESEARCH.2026

- **Engineering metabolite-sensing NK and T cells to target solid tumors** *NATURE IMMUNOLOGY*

  Jerby, L.

  2026

- **Gradient-aware modeling advances AI-driven prediction of genetic perturbation effects.** *bioRxiv : the preprint server for biology*

  Zhu, D., Jerby, L.

  2025

- **Robust self-supervised machine learning for single cell embeddings and annotations.** *bioRxiv : the preprint server for biology*

  Yeh, C. Y., Sun, M. W., Zhu, D., Jerby, L.

  2025

- **Redirecting cytotoxic lymphocytes to breast cancer tumors via metabolite-sensing receptors.** *bioRxiv : the preprint server for biology*

  Kim, Y. M., Akana, R. V., Sun, C., Laveroni, O., Jerby, L.

  2025

- **Gradient Aligned Regression via Pairwise Losses** *International Conference on Machine Learning (ICML)*

  Zhu, D., Yang, T., Jerby, L.

  2025

- **Deciphering the impact of genomic variation on function.** *Nature*

  2024; 633 (8028): 47-57

- **Pan-cancer mapping of single CD8+ T cell profiles reveals a TCF1:CXCR6 axis regulating CD28 co-stimulation and anti-tumor immunity.** *Cell reports. Medicine*

  Tooley, K., Jerby, L., Escobar, G., Krovi, S. H., Mangani, D., Dandekar, G., Cheng, H., Madi, A., Goldschmidt, E., Lambden, C., Krishnan, R. K., Rozenblatt-Rosen, O., Regev, et al

  2024: 101640

- **Multimodal CRISPR activation screens reveal new mechanisms to sensitize cancer cells to targeted T cell mediated elimination**

  Akana, R. V., Sun, C., Kim, Y., Cai, Y., Kim, S., Yoe, J., Laveroni, O., Jerby-Arnon, L.

  AMER ASSOC CANCER RESEARCH.2024

- **Mapping ovarian cancer spatial organization uncovers immune evasion drivers at the genetic, cellular, and tissue level**

  Yeh, C. Y., Aguirre, ., Laveroni, O., Kim, S., Wang, A., Liang, B., Zhang, X., Han, L., Valbuena, R., Plevritis, S. K., Bassik, M. C., Snyder, M. P., Howitt, et al

  bioRxiv.

  2023

- **Author Correction: Massively parallel phenotyping of coding variants in cancer with Perturb-seq.** *Nature biotechnology*

  Ursu, O., Neal, J. T., Shea, E., Thakore, P. I., Jerby-Arnon, L., Nguyen, L., Dionne, D., Diaz, C., Bauman, J., Mosaad, M. M., Fagre, C., Lo, A., McSharry, et al

2022

- **Spatial transcriptomics** *CANCER CELL*
  Anderson, A. C., Yanai, I., Yates, L. R., Wang, L., Swarbrick, A., Sorger, P., Santagata, S., Fridman, W. H., Gao, Q., Jerby, L., Izar, B., Shang, L., Zhou, et al
  2022; 40 (9): 895-900

- **Inter-cellular CRISPR screens reveal regulators of cancer cell phagocytosis.** *Nature*
  Kamber, R. A., Nishiga, Y., Morton, B., Banuelos, A. M., Barkal, A. A., Vences-Catalan, F., Gu, M., Fernandez, D., Seoane, J. A., Yao, D., Liu, K., Lin, S., Spees, et al
  2021

- **Multimodal pooled Perturb-CITE-seq screens in patient models define mechanisms of cancer immune evasion** *NATURE GENETICS*
  Frangieh, C. J., Melms, J. C., Thakore, P. I., Geiger-Schuller, K. R., Ho, P., Luoma, A. M., Cleary, B., Jerby-Arnon, L., Malu, S., Cuoco, M. S., Zhao, M., Ager, C. R., Rogava, et al
  2021: 332–41

- **Serine biosynthesis is a metabolic vulnerability in IDH2-driven breast cancer progression.** *Cancer research*
  Barnabas, G. D., Sang Lee, J., Shami, T., Harel, M., Beck, L., Selitrennik, M., Jerby-Arnon, L., Erez, N., Ruppin, E., Geiger, T.
  2021

- **Inhibitory CD161 receptor identified in glioma-infiltrating T cells by single-cell analysis.** *Cell*
  Mathewson, N. D., Ashenberg, O. n., Tirosh, I. n., Gritsch, S. n., Perez, E. M., Marx, S. n., Jerby-Arnon, L. n., Chanoch-Myers, R. n., Hara, T. n., Richman, A. R., Ito, Y. n., Pyrdol, J. n., Friedrich, et al
  2021

- **A Distinct Transcriptional Program in Human CAR T Cells Bearing the 4-1BB Signaling Domain Revealed by scRNA-Seq.** *Molecular therapy : the journal of the American Society of Gene Therapy*
  Boroughs, A. C., Larson, R. C., Marjanovic, N. D., Gosik, K., Castano, A. P., Porter, C. B., Lorrey, S. J., Ashenberg, O., Jerby, L., Hofree, M., Smith-Rosario, G., Morris, R., Gould, et al
  2020; 28 (12): 2577-2592

- **A single-cell landscape of high-grade serous ovarian cancer** *NATURE MEDICINE*
  Izar, B., Tirosh, I., Stover, E. H., Wakiro, I., Cuoco, M. S., Alter, I., Rodman, C., Leeson, R., Su, M., Shah, P., Iwanicki, M., Walker, S. R., Kanodia, et al
  2020; 26 (8): 1271-+

- **A single-cell and single-nucleus RNA-Seq toolbox for fresh and frozen human tumors** *NATURE MEDICINE*
  Slyper, M., Porter, C. B. M., Ashenberg, O., Waldman, J., Drokhlyansky, E., Wakiro, I., Smillie, C., Smith-Rosario, G., Wu, J., Dionne, D., Vigneau, S., Jane-Valbuena, J., Tickle, et al
  2020; 26 (5): 792-+

- **Integrative molecular and clinical modeling of clinical outcomes to PD1 blockade in patients with metastatic melanoma** *NATURE MEDICINE*
  Liu, D., Schilling, B., Liu, D., Sucker, A., Livingstone, E., Jerby-Amon, L., Zimmer, L., Gutzmer, R., Satzger, I., Loquai, C., Grabbe, S., Vokes, N., Margolis, et al
  2019; 25 (12): 1916-+

- **Genome-wide prediction of synthetic rescue mediators of resistance to targeted and immunotherapy** *MOLECULAR SYSTEMS BIOLOGY*
  Das Sahu, A., Lee, J. S., Wang, Z., Zhang, G., Iglesias-Bartolome, R., Tian, T., We, Z., Miao, B., Nair, N., Ponomarova, O., Friedman, A. A., Amzallag, A., Moll, et al
  2019; 15 (3): e8323

- **IL-33 Signaling Alters Regulatory T Cell Diversity in Support of Tumor Development.** *Cell reports*
  Li, A. n., Herbst, R. H., Canner, D. n., Schenkel, J. M., Smith, O. C., Kim, J. Y., Hillman, M. n., Bhutkar, A. n., Cuoco, M. S., Rappazzo, C. G., Rogers, P. n., Dang, C. n., Jerby-Arnon, et al
  2019; 29 (10): 2998–3008.e8

- **Harnessing synthetic lethality to predict the response to cancer treatment** *NATURE COMMUNICATIONS*
  Lee, J., Das, A., Jerby-Arnon, L., Arafeh, R., Auslander, N., Davidson, M., McGarry, L., James, D., Amzallag, A., Park, S., Cheng, K., Robinson, W., Atias, et al
  2018; 9: 2546

- **Perturb-Seq: Dissecting Molecular Circuits with Scalable Single-Cell RNA Profiling of Pooled Genetic Screens** *CELL*
  Dixit, A., Pamas, O., Li, B., Chen, J., Fulco, C. P., Jerby-Amon, L., Marjanovic, N. D., Dionne, D., Burks, T., Raychowdhury, R., Adamson, B., Norman, T. M., Lander, et al
  2016; 167 (7): 1853-+

- **Genome-scale study reveals reduced metabolic adaptability in patients with non-alcoholic fatty liver disease** *NATURE COMMUNICATIONS*
  Hyotylainen, T., Jerby, L., Petaja, E. M., Mattila, I., Jantti, S., Auvinen, P., Gastaldelli, A., Yki-Jarvinen, H., Ruppin, E., Oresic, M.
  2016; 7: 8994

- **Fumarate induces redox-dependent senescence by modifying glutathione metabolism** *NATURE COMMUNICATIONS*
  Zheng, L., Cardaci, S., Jerby, L., MacKenzie, E. D., Sciacovelli, M., Johnson, T., Gaude, E., King, A., Leach, J. D. G., Edrada-Ebel, R., Hedley, A., Morrice, N. A., Kalna, et al
  2015; 6: 6001

- **Moving ahead on harnessing synthetic lethality to fight cancer** *MOLECULAR & CELLULAR ONCOLOGY*
  Jerby-Arnon, L., Ruppin, E.
  2015; 2 (2): e977150

- **Metabolic Associations of Reduced Proliferation and Oxidative Stress in Advanced Breast Cancer** *CANCER RESEARCH*
  Jerby, L., Wolf, L., Denkert, C., Stein, G. Y., Hilvo, M., Oresic, M., Geiger, T., Ruppin, E.
  2012; 72 (22): 5712–20

- **Predicting Drug Targets and Biomarkers of Cancer via Genome-Scale Metabolic Modeling** *CLINICAL CANCER RESEARCH*
  Jerby, L., Ruppin, E.
  2012; 18 (20): 5572–84

- **Haem oxygenase is synthetically lethal with the tumour suppressor fumarate hydratase** *NATURE*
  Frezza, C., Zheng, L., Folger, O., Rajagopalan, K. N., MacKenzie, E. D., Jerby, L., Micaroni, M., Chaneton, B., Adam, J., Hedley, A., Kalna, G., Tomlinson, I. P. M., Pollard, et al
  2011; 477 (7363): 225–U132

- **Predicting selective drug targets in cancer through metabolic networks** *MOLECULAR SYSTEMS BIOLOGY*
  Folger, O., Jerby, L., Frezza, C., Gottlieb, E., Ruppin, E., Shlomi, T.
  2011; 7: 501

- **Computational reconstruction of tissue-specific metabolic models: application to human liver metabolism** *MOLECULAR SYSTEMS BIOLOGY*
  Jerby, L., Shlomi, T., Ruppin, E.
  2010; 6: 401