Stanford



James Ferrell

Professor of Chemical and Systems Biology and of Biochemistry

Bio

ACADEMIC APPOINTMENTS

- Professor, Chemical and Systems Biology
- Professor, Biochemistry
- Member, Bio-X
- Member, Stanford Cancer Institute
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Chair, Stanford University School of Medicine - Chemical & Systems Biology, (2006-2011)
- Associate Chair, Stanford University School of Medicine - Chemical & Systems Biology, (2011-2012)

PROFESSIONAL EDUCATION

- B.A., Williams College , Physics, Chemistry, Mathematics (1976)
- Ph.D., Stanford University , Chemistry (1984)
- M.D., Stanford University (1986)

COMMUNITY AND INTERNATIONAL WORK

- PRD-1-Day Band Performance, Opening Ceremony, Guangzhou Triennial, Guangzhou, China

PATENTS

- James Ferrell, Jason Myers. "United States Patent 7,556,944 Methods and compositions for use in preparing siRNAs", Leland Stanford Junior University, Jul 7, 2009

LINKS

- Ferrell Lab Home Page: https://web.stanford.edu/group/ferrelllab/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My lab has two main goals: to understand the regulation of mitosis and to understand the systems-level logic of simple signaling circuits. We often make use of Xenopus laevis oocytes, eggs, and cell-free extracts for both sorts of study. We also carry out single-cell fluorescence imaging studies on mammalian cell lines. Our experimental work is complemented by computational and theoretical studies aimed at understanding the design principles and recurring themes of regulatory circuits.

Teaching

COURSES

2026-27

- Modeling Cell Signaling: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)
- Systems Biology: Principles of Cell Signaling: BIO 188, BIO 288, CSB 288 (Aut)

2025-26

- Modeling Cell Signaling: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)

2024-25

- Modeling Cell Signaling: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)

2023-24

- Biological Macromolecules: BIOC 241, BIOE 241, BIOPHYS 241, SBIO 241 (Aut)
- Modeling Cell Signaling: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Eli Costa, Larissa Sambel, Saman Tabatabaee, Gabriel Tauber, Jordan Valgardson, Alex Van Elgort

Postdoctoral Faculty Sponsor

Muziyue Wu, Huan Zheng

Doctoral Dissertation Advisor (AC)

Tomoko Oshima

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biochemistry (PhD Program)
- Biomedical Data Science (PhD Program)
- Biophysics (PhD Program)
- Cancer Biology (PhD Program)
- Chemical and Systems Biology (PhD Program)

Publications

PUBLICATIONS

- **Stable epigenetic states set single-cell activation thresholds in mammalian expression systems.** *bioRxiv : the preprint server for biology*
  Costa, E. J., Rios-Martinez, C., Andrews, C. J., Ferrell, J. E., Bintu, L.
  2026
- **Global trends in human birth and death seasonality reveal climate-related shifts in reproductive timing.** *bioRxiv : the preprint server for biology*
  Lalgudi, C., Sakariya, N., Ferrell, J. E., Liu, S.

2026

- **How does cytoplasmic crowding affect reaction rates?** *Molecular cell*
  Huang, J. H., Ferrell, J. E.
  2025
- **Geometrical compartmentalization of trigger waves.** *Proceedings of the National Academy of Sciences of the United States of America*
  Li, Z., Zhang, K. S., Chen, Y., Tang, S. K., Ferrell, J. E.
  2025; 122 (40): e2512872122
- **Mechanistic origins of temperature scaling in the early embryonic cell cycle.** *Nature communications*
  Rombouts, J., Tavella, F., Vandervelde, A., Phong, C., Ferrell, J. E., Yang, Q., Gelens, L.
  2025; 16 (1): 8045
- **Mouse lemur cell atlas informs primate genes, physiology and disease.** *Nature*
  Ezran, C., Liu, S., Chang, S., Ming, J., Guethlein, L. A., Wang, M. F., Dehghannasiri, R., Olivieri, J., Frank, H. K., Tarashansky, A., Koh, W., Jing, Q., Botvinnik, et al
  2025
- **A molecular cell atlas of mouse lemur, an emerging model primate.** *Nature*
  Ezran, C., Liu, S., Chang, S., Ming, J., Botvinnik, O., Penland, L., Tarashansky, A., de Morree, A., Travaglini, K. J., Zhao, J., Wang, G., Hasegawa, K., Sin, et al
  2025
- **Change of venue: fission-yeast cell-division cues actually initiate in the nucleus** *NATURE*
  Kamenz, J., Ferrell Jr, J. E.
  2025
- **Long-range regulation of transcription scales with genomic distance in a gene-specific manner.** *Molecular cell*
  Jensen, C. L., Chen, L. F., Swigut, T., Crocker, O. J., Yao, D., Bassik, M. C., Ferrell, J. E., Boettiger, A. N., Wysocka, J.
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- **Robust trigger wave speed in Xenopus cytoplasmic extracts.** *Nature communications*
  Huang, J. H., Chen, Y., Huang, W. Y., Tabatabaee, S., Ferrell, J. E.
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- **An organism-wide atlas of hormonal signaling based on the mouse lemur single-cell transcriptome.** *Nature communications*
  Liu, S., Ezran, C., Wang, M. F., Li, Z., Awayan, K., Long, J. Z., De Vlaminck, I., Wang, S., Epelbaum, J., Kuo, C. S., Terrien, J., Krasnow, M. A., Ferrell, et al
  2024; 15 (1): 2188
- **Viscosity-dependent control of protein synthesis and degradation.** *Nature communications*
  Chen, Y., Huang, J. H., Phong, C., Ferrell, J. E.
  2024; 15 (1): 2149
- **Membrane localization accelerates association under conditions relevant to cellular signaling.** *Proceedings of the National Academy of Sciences of the United States of America*
  Huang, W. Y., Boxer, S. G., Ferrell, J. E.
  2024; 121 (10): e2319491121
- **Measuring Molecular Diffusion in Self-Organizing Xenopus Extracts by Fluorescence Correlation Spectroscopy.** *Methods in molecular biology (Clifton, N.J.)*
  Huang, W. Y., Ferrell, J. E., Cheng, X.
  2024; 2740: 107-115
- **Ultrafast distant wound response is essential for whole-body regeneration.** *Cell*
  Fan, Y., Chai, C., Li, P., Zou, X., Ferrell, J. E., Wang, B.
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- **Cytoplasmic organization promotes protein diffusion in Xenopus extracts.** *Nature communications*
  Huang, W. Y., Cheng, X., Ferrell, J. E.

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- **Stepwise Oxidations Play Key Roles in the Structural and Functional Regulations of DJ-1.** *The Biochemical journal*
  Song, I., Kim, M., Ferrell, J. E., Shin, D., Lee, K.
  2021
- **Xenopus laevis Egg Extract Preparation and Live Imaging Methods for Visualizing Dynamic Cytoplasmic Organization.** *Journal of visualized experiments : JoVE*
  Cheng, X., Ferrell, J. E.
  2021
- **C. elegans colony formation as a condensation phenomenon.** *Nature communications*
  Chen, Y., Ferrell, J. E.
  2021; 12 (1): 4947
- **Real-Time Monitoring of APC /C-Mediated Substrate Degradation Using Xenopus laevis Egg Extracts.** *Methods in molecular biology (Clifton, N.J.)*
  Kamenz, J., Qiao, R., Yang, Q., Ferrell, J. E.
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- **Bistable, Biphasic Regulation of PP2A-B55 Accounts for the Dynamics of Mitotic Substrate Phosphorylation.** *Current biology : CB*
  Kamenz, J., Gelens, L., Ferrell, J. E.
  2020
- **The nucleus serves as the pacemaker for the cell cycle.** *eLife*
  Afanzar, O., Buss, G. K., Stearns, T., Ferrell, J. E.
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- **The Apparent Requirement for Protein Synthesis during G2 Phase Is due to Checkpoint Activation.** *Cell reports*
  Lockhead, S. n., Moskaleva, A. n., Kamenz, J. n., Chen, Y. n., Kang, M. n., Reddy, A. R., Santos, S. D., Ferrell, J. E.
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- **Efficient Front-Rear Coupling in Neutrophil Chemotaxis by Dynamic Myosin II Localization** *DEVELOPMENTAL CELL*
  Tsai, T., Collins, S. R., Chan, C. K., Hadjitheodorou, A., Lam, P., Lou, S. S., Yang, H., Jorgensen, J., Ellett, F., Irimia, D., Davidson, M. W., Fischer, R. S., Huttenlocher, et al
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- **Disruption of Telomerase RNA Maturation Kinetics Precipitates Disease.** *Molecular cell*
  Roake, C. M., Chen, L., Chakravarthy, A. L., Ferrell, J. E., Raffa, G. D., Artandi, S. E.
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- **A compact synthetic pathway rewires cancer signaling to therapeutic effector release.** *Science (New York, N.Y.)*
  Chung, H. K., Zou, X. n., Bajar, B. T., Brand, V. R., Huo, Y. n., Alcudia, J. F., Ferrell, J. E., Lin, M. Z.
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- **Spontaneous emergence of cell-like organization in Xenopus egg extracts.** *Science (New York, N.Y.)*
  Cheng, X. n., Ferrell, J. E.
  2019; 366 (6465): 631–37
- **Robustly Cycling Xenopus laevis Cell-Free Extracts in Teflon Chambers.** *Cold Spring Harbor protocols*
  Chang, J. B., Ferrell, J. E.
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- **Apoptosis propagates through the cytoplasm as trigger waves.** *Science (New York, N.Y.)*
  Cheng, X. n., Ferrell, J. E.
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  Kamenz, J., Ferrell, J. E.
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- **Calcium Ion Induced Structural Changes Promote Dimerization of Secretagogin, Which Is Required for Its Insulin Secretory Function.** *Scientific reports*
  Lee, J. J., Yang, S. Y., Park, J. n., Ferrell, J. E., Shin, D. H., Lee, K. J.
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  Ha, S. H., Ferrell, J. E.
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- **Perfect and Near-Perfect Adaptation in Cell Signaling.** *Cell systems*
  Ferrell, J. E.
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  Ha, S. H., Kim, S. Y., Ferrell, J. E.
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- **How Does the Xenopus laevis Embryonic Cell Cycle Avoid Spatial Chaos?** *CELL REPORTS*
  Gelens, L., Huang, K. C., Ferrell, J. E.
  2015; 12 (5): 892-900
- **Ultrasensitivity part III: cascades, bistable switches, and oscillators** *TRENDS IN BIOCHEMICAL SCIENCES*
  Ferrell, J. E., Ha, S. H.
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- **Spatial trigger waves: positive feedback gets you a long way.** *Molecular biology of the cell*
  Gelens, L., Anderson, G. A., Ferrell, J. E.
  2014; 25 (22): 3486-3493
- **Ultrasensitivity part II: multisite phosphorylation, stoichiometric inhibitors, and positive feedback** *TRENDS IN BIOCHEMICAL SCIENCES*
  Ferrell, J. E., Ha, S. H.
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- **Ultrasensitivity part I: Michaelian responses and zero-order ultrasensitivity** *TRENDS IN BIOCHEMICAL SCIENCES*
  Ferrell, J. E., Ha, S. H.
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  Tsai, T. Y., Theriot, J. A., Ferrell, J. E.
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  Ferrell, J. E.
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  Chang, J. B., Ferrell, J. E.
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- **The Cdk1-APC/C cell cycle oscillator circuit functions as a time-delayed, ultrasensitive switch.** *Nature cell biology*
  Yang, Q., Ferrell, J. E.
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  Santos, S. D., Wollman, R., Meyer, T., Ferrell, J. E.
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- **Bistability, Bifurcations, and Waddington's Epigenetic Landscape** *CURRENT BIOLOGY*
  Ferrell, J. E.
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- **Dora B. Goldstein 1922-2011 OBITUARY** *ADDICTION*
  Ferrell, J. E.
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  Anderson, G. A., Liu, X., Ferrell, J. E.
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  Pearlman, S. M., Serber, Z., Ferrell, J. E.
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  Ferrell, J. E.
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  Santos, S. D., Ferrell, J. E.
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- **Mechanisms of specificity in protein phosphorylation** *NATURE REVIEWS MOLECULAR CELL BIOLOGY*
  Ubersax, J. A., Ferrell, J. E.
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  Kim, S. Y., Ferrell, J. E.
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- **Tuning bulk electrostatics to regulate protein function** *CELL*
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  Yue, J., Xiong, W., Ferrell, J. E.
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- **A noisy 'Start' to the cell cycle** *MOLECULAR SYSTEMS BIOLOGY*
  Ubersax, J. A., Ferrell, J. E.
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  Gong, D. Q., Ferrell, J. E.
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