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

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)

2022-23

- Research Seminar: CSB 270 (Aut, Win, Spr)

2021-22

- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win)

2020-21

- Advanced Cell Biology: BIO 214, BIOC 224, MCP 221 (Win)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Katie Ferrick, Christina Jensen, Jacob Kim, Ramon Lorenzo Labitigan, Larissa Sambel, Joydeb Sinha, Gabriel Tauber, Jordan Valgardson, Alex Van Elgort

Postdoctoral Faculty Sponsor

Yuping Chen, Zhengda Li, Shixuan Liu

Doctoral Dissertation Advisor (AC)

Katie Ferrick, Jo-Hsi Huang

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biochemistry (Phd Program)
- Biomedical Informatics (Phd Program)
- Biophysics (Phd Program)
- Cancer Biology (Phd Program)
- Chemical and Systems Biology (Phd Program)

Publications

PUBLICATIONS

- **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.
  2023
- **Cytoplasmic organization promotes protein diffusion in Xenopus extracts.** *Nature communications*
  Huang, W. Y., Cheng, X., Ferrell, J. E.
  2022; 13 (1): 5599
- **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.
  2021; 2329: 29-38
- **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.
  2020; 9
- **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.
  2020; 32 (2): 107901
- **SYNTHETIC BIOLOGY A compact synthetic pathway rewires cancer signaling to therapeutic effector release** *SCIENCE*
  Chung, H. K., Zou, X., Bajar, B. T., Brand, V. R., Huo, Y., Alcudia, J. F., Ferrell, J. E., Lin, M. Z.
  2019; 364 (6439): 451-+
- **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
  2019; 49 (2): 189-+
- **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.
  2019

- **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.
  2019; 364 (6439)
- **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
- **Efficient Front-Rear Coupling in Neutrophil Chemotaxis by Dynamic Myosin II Localization.** *Developmental cell*
  Tsai, T. Y., Collins, S. R., Chan, C. K., Hadjitheodorou, A. n., Lam, P. Y., Lou, S. S., Yang, H. W., Jorgensen, J. n., Ellett, F. n., Irimia, D. n., Davidson, M. W., Fischer, R. S., Huttenlocher, et al
  2019; 49 (2): 189–205.e6
- **Robustly Cycling Xenopus laevis Cell-Free Extracts in Teflon Chambers.** *Cold Spring Harbor protocols*
  Chang, J. B., Ferrell, J. E.
  2018
- **Apoptosis propagates through the cytoplasm as trigger waves.** *Science (New York, N.Y.)*
  Cheng, X. n., Ferrell, J. E.
  2018; 361 (6402): 607–12
- **The Temporal Ordering of Cell-Cycle Phosphorylation.** *Molecular cell*
  Kamenz, J., Ferrell, J. E.
  2017; 65 (3): 371-373
- **Desynchronizing Embryonic Cell Division Waves Reveals the Robustness of Xenopus laevis Development.** *Cell reports*
  Anderson, G. A., Gelens, L. n., Baker, J. C., Ferrell, J. E.
  2017; 21 (1): 37–46
- **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.
  2017; 7 (1): 6976
- **Thresholds and ultrasensitivity from negative cooperativity** *SCIENCE*
  Ha, S. H., Ferrell, J. E.
  2016; 352 (6288): 990-993
- **Perfect and Near-Perfect Adaptation in Cell Signaling.** *Cell systems*
  Ferrell, J. E.
  2016; 2 (2): 62-67
- **The Prozone Effect Accounts for the Paradoxical Function of the Cdk-Binding Protein Suc1/Cks** *CELL REPORTS*
  Ha, S. H., Kim, S. Y., Ferrell, J. E.
  2016; 14 (6): 1408-1421
- **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.
  2014; 39 (12): 612-618
- **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.
  2014; 39 (11): 556-569

- **Ultrasensitivity part I: Michaelian responses and zero-order ultrasensitivity** *TRENDS IN BIOCHEMICAL SCIENCES*
  Ferrell, J. E., Ha, S. H.
  2014; 39 (10): 496-503
- **Changes in oscillatory dynamics in the cell cycle of early Xenopus laevis embryos.** *PLoS biology*
  Tsai, T. Y., Theriot, J. A., Ferrell, J. E.
  2014; 12 (2)
- **Feedback loops and reciprocal regulation: recurring motifs in the systems biology of the cell cycle** *CURRENT OPINION IN CELL BIOLOGY*
  Ferrell, J. E.
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- **Mitotic trigger waves and the spatial coordination of the Xenopus cell cycle.** *Nature*
  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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- **Spatial Positive Feedback at the Onset of Mitosis** *CELL*
  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.
  2012; 22 (11): R458-R466
- **Dora B. Goldstein 1922-2011 OBITUARY** *ADDICTION*
  Ferrell, J. E.
  2012; 107 (5): 1013-1014
- **Bistability in one equation or fewer.** *Methods in molecular biology (Clifton, N.J.)*
  Anderson, G. A., Liu, X., Ferrell, J. E.
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- **A Mechanism for the Evolution of Phosphorylation Sites** *CELL*
  Pearlman, S. M., Serber, Z., Ferrell, J. E.
  2011; 147 (4): 934-946
- **Simple Rules for Complex Processes: New Lessons from the Budding Yeast Cell Cycle** *MOLECULAR CELL*
  Ferrell, J. E.
  2011; 43 (4): 497-500
- **Modeling the Cell Cycle: Why Do Certain Circuits Oscillate?** *CELL*
  Ferrell, J. E., Tsai, T. Y., Yang, Q.
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- **Ultrasensitivity in the Regulation of Cdc25C by Cdk1** *MOLECULAR CELL*
  Trunnell, N. B., Poon, A. C., Kim, S. Y., Ferrell, J. E.
  2011; 41 (3): 263-274
- **The Roles of Cyclin A2, B1, and B2 in Early and Late Mitotic Events** *MOLECULAR BIOLOGY OF THE CELL*
  Gong, D., Ferrell, J. E.
  2010; 21 (18): 3149-3161
- **Systems biologists seek fuller integration of systems biology approaches in new cancer research programs.** *Cancer research*
  Wolkenhauer, O., Auffray, C., Baltrusch, S., Blüthgen, N., Byrne, H., Cascante, M., Ciliberto, A., Dale, T., Drasdo, D., Fell, D., Ferrell, J. E., Gallahan, D., Gatenby, et al
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  Ferrell, J. E., Pomerening, J. R., Kim, S. Y., Trunnell, N. B., Xiong, W., Huang, C. F., Machleder, E. M.
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- **Signaling Motifs and Weber's Law** *MOLECULAR CELL*
  Ferrell, J. E.
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- **Concordant Regulation of Translation and mRNA Abundance for Hundreds of Targets of a Human microRNA** *PLOS BIOLOGY*
  Hendrickson, D. G., Hogan, D. J., McCullough, H. L., Myers, J. W., Herschlag, D., Ferrell, J. E., Brown, P. O.
  2009; 7 (11)
- **Tuning the Activation Threshold of a Kinase Network by Nested Feedback Loops** *SCIENCE*
  Justman, Q. A., Serber, Z., Ferrell, J. E., El-Samad, H., Shokat, K. M.
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  Aebersold, R., Auffray, C., Baney, E., Barillot, E., Brazma, A., Brett, C., Brunak, S., Butte, A., Califano, A., Celis, J., Cufer, T., Ferrell, J., Galas, et al
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- **Q&A: systems biology.** *Journal of biology*
  Ferrell, J. E.
  2009; 8 (1): 2-?
- **Q&A: Cooperativity.** *Journal of biology*
  Ferrell, J. E.
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- **Rapid cycling and precocious termination of G1 phase in cells expressing CDK1AF** *MOLECULAR BIOLOGY OF THE CELL*
  Pomerening, J. R., Ubersax, J. A., Ferrell, J. E.
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- **Systems biology - On the cell cycle and its switches** *NATURE*
  Santos, S. D., Ferrell, J. E.
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- **Robust, tunable biological oscillations from interlinked positive and negative feedback loops** *SCIENCE*
  Tsai, T. Y., Choi, Y. S., Ma, W., Pomerening, J. R., Tang, C., Ferrell, J. E.
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  Hendrickson, D. G., Hogan, D. J., Herschlag, D., Ferrell, J. E., Brown, P. O.
  2008; 3 (5)
- **Feedback regulation of opposing enzymes generates robust, all-or-more bistable responses** *CURRENT BIOLOGY*
  Ferrell, J. E.
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- **Systems biology. A clock with a flip switch.** *Science*
  Poon, A. C., 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*
  Serber, Z., Ferrell, J. E.
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  Gong, D., Pomerening, J. R., Myers, J. W., Gustavsson, C., Jones, J. T., Hahn, A. T., Meyer, T., Ferrell, J. E.
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  Yue, J., Ferrell, J. E.
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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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  Myers, J. W., Chi, J., Gong, D., Schaner, M. E., Brown, P. O., Ferrell, J. E.
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  Serber, Z., Selenko, P., Haensel, R., Reckel, S., Loehr, F., Ferrell, J. E., Wagner, G., Doetsch, V.
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- **Systems-level dissection of the cell-cycle oscillator: Bypassing positive feedback produces damped oscillations** *CELL*
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  Liou, J., Kim, M. L., Heo, W. D., Jones, J. T., MYERS, J. W., Ferrell, J. E., Meyer, T.
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  GREEN, S. L., Westendorf, J. M., Jaffe, H., Pant, H. C., CORK, L. C., Ostrander, E. A., Vignaux, F., Ferrell, J. E.
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- **Dicer in RNAi: its roles in vivo and utility in vitro** *In: RNA Interference. From Basic Science to Drug Development. Edited by Appasani K, Cambridge University Press, Cambridge UK*
  Myers JW, Ferrell JE Jr.
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- **Identification and comparative analysis of multiple mammalian Speedy/Ringo proteins** *CELL CYCLE*
  Cheng, A., Xiong, W., Ferrell, J. E., Solomon, M. J.
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- **Silencing gene expression with Dicer-generated siRNA pools.** *Methods in molecular biology (Clifton, N.J.)*
  Myers, J. W., Ferrell, J. E.
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- **Mos mediates the mitotic activation of p42 MAPK in Xenopus egg extracts** *CURRENT BIOLOGY*
  Yue, J. B., Ferrell, J. E.
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- **Picking a winner: new mechanistic insights into the design of effective siRNAs** *TRENDS IN BIOTECHNOLOGY*
  Gong, D. Q., Ferrell, J. E.
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- **Probing the precision of the mitotic clock with a live-cell fluorescent biosensor** *NATURE BIOTECHNOLOGY*
  Jones, J. T., MYERS, J. W., Ferrell, J. E., Meyer, T.
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  Xiong, W., Ferrell, J. E.
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  Fink, C. C., Bayer, K. U., MYERS, J. W., Ferrell, J. E., Schulman, H., Meyer, T.
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- **Building a cell cycle oscillator: hysteresis and bistability in the activation of Cdc2** *NATURE CELL BIOLOGY*
  Pomerening, J. R., Sontag, E. D., Ferrell, J. E.
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  Bagowski, C. P., Besser, J., Frey, C. R., Ferrell, J. E.
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  Ferrell, J. E., Cimprich, K. A.
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  Bagowski, C. P., Ferrell, J. E.
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