

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: <http://www.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

2019-20

- Advanced Cell Biology: BIO 214, BIOC 224, MCP 221 (Win)
- Molecular Foundations of Medicine: BIOC 205 (Aut)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Aut)
- Research Seminar: CSB 270 (Aut, Win, Spr)

2018-19

- Advanced Cell Biology: BIO 214, BIOC 224, MCP 221 (Win)
- Biological Macromolecules: BIOC 241 (Spr)
- Molecular Foundations of Medicine: BIOC 205 (Aut)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Aut)

2017-18

- Biological Macromolecules: BIOC 241, BIOE 241, BIOPHYS 241, SBIO 241 (Win)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Aut)

2016-17

- Biological Macromolecules: BIOC 241 (Spr)
- Practical Tutorial on the Modeling of Signal Transduction Motifs: BIOS 204 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Anjali Bisaria, Michael Enos, Yilin Fan, Katie Ferrick, Caleb Glassman, Takamasa Kudo, Ramon Lorenzo Labitigan, Nalin Ratnayake, Ron Shanderson, Joydeb Sinha, Michael Swift, Benjamin Topacio, Jeremy Work

Orals Chair

Daniel Berenson

Postdoctoral Faculty Sponsor

Oshri Afanzar, Yuping Chen, Yuxin Chen, William Huang, Julia Kamenz, Zhengda Li, Shixuan Liu, Connie Phong

Orals Evaluator

Anjali Bisaria, Yiwen Chen, Leighton Daigh

Doctoral Dissertation Advisor (AC)

Lawrence Chiou

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

- **Disruption of Telomerase RNA Maturation Kinetics Precipitates Disease** *Molecular Cell*
Roake, C. M., Chen, L., Chakravarthy, A., Raffa, G. D., Ferrell, Jr., J. E., Artandi, S. E.
2019
- **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., 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., Baker, J. C., Ferrell, J. E.
2017; 21 (1): 37–46
- **Calcium Ion Induced Structural Changes Promote Dimerization of Secretagoin, Which Is Required for Its Insulin Secretory Function.** *Scientific reports*
Lee, J. J., Yang, S. Y., Park, J., 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
- **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 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.
2013; 25 (6): 676-686
- **Mitotic trigger waves and the spatial coordination of the *Xenopus* cell cycle.** *Nature*
Chang, J. B., Ferrell, J. E.
2013; 500 (7464): 603-607
- **The Cdk1-APC/C cell cycle oscillator circuit functions as a time-delayed, ultrasensitive switch.** *Nature cell biology*
Yang, Q., Ferrell, J. E.
2013; 15 (5): 519-525
- **Spatial Positive Feedback at the Onset of Mitosis** *CELL*
Santos, S. D., Wollman, R., Meyer, T., Ferrell, J. E.
2012; 149 (7): 1500-1513
- **Bistability, Bifurcations, and Waddington's Epigenetic Landscape** *CURRENT BIOLOGY*
Ferrell, J. E.
2012; 22 (11): R458-R466
- **Bistability in one equation or fewer.** *Methods in molecular biology (Clifton, N.J.)*
Anderson, G. A., Liu, X., Ferrell, J. E.
2012; 880: 53-67
- **Obituary: Dora B. Goldstein 1922-2011** *ADDICTION*
Ferrell, J. E.
2012; 107: 1013-4
- **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.
2011; 144 (6): 874-885
- **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
- **Cooperative phosphorylation in the regulation of Wee1A**
Kim, S. Y., Ferrell, J. E.
FEDERATION AMER SOC EXP BIOL.2010
- **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
2010; 70 (1): 12-13

- **Simple, realistic models of complex biological processes: Positive feedback and bistability in a cell fate switch and a cell cycle oscillator** *146th Nobel Symposium on Systems Biology*
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.
2009; 36 (5): 724-727
- **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.
2009; 324 (5926): 509-512
- **Report on EU-USA Workshop: How Systems Biology Can Advance Cancer Research (27 October 2008)** *MOLECULAR ONCOLOGY*
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
2009; 3 (1): 9-17
- **Q&A: systems biology.** *Journal of biology*
Ferrell, J. E.
2009; 8 (1): 2-?
- **Q&A: Cooperativity.** *Journal of biology*
Ferrell, J. E.
2009; 8 (6): 53-?
- **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.
2008; 19 (8): 3426-3441
- **Systems biology - On the cell cycle and its switches** *NATURE*
Santos, S. D., Ferrell, J. E.
2008; 454 (7202): 288-289
- **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.
2008; 321 (5885): 126-129
- **Systematic Identification of mRNAs Recruited to Argonaute 2 by Specific microRNAs and Corresponding Changes in Transcript Abundance** *PLOS ONE*
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.
2008; 18 (6): R244-R245
- **A role for GPRx, a novel GPR3/6/12-related G-protein coupled receptor, in the maintenance of meiotic arrest in Xenopus laevis oocytes** *Dev Biol*
Rios-Cardona D, Ricardo-Gonzalez RR, Chawla A, Ferrell JE Jr.
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- **Systems biology. A clock with a flip switch.** *Science*
Poon, A. C., Ferrell, J. E.
2007; 318 (5851): 757-758
- **Mechanisms of specificity in protein phosphorylation** *NATURE REVIEWS MOLECULAR CELL BIOLOGY*
Ubersax, J. A., Ferrell, J. E.
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- **Substrate competition as a source of ultrasensitivity in the inactivation of Wee1** *CELL*
Kim, S. Y., Ferrell, J. E.
2007; 128 (6): 1133-1145
- **Emi2 at the crossroads - Where CSF meets MPF** *CELL CYCLE*
Hansen, D. V., Pomerening, J. R., Summers, M. K., Miller, J. J., Ferrell, J. E., Jackson, P. K.
2007; 6 (6): 732-738
- **Tuning bulk electrostatics to regulate protein function** *CELL*
Serber, Z., Ferrell, J. E.
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- **Cyclin A2 regulates nuclear-envelope breakdown and the nuclear accumulation of cyclin B1** *CURRENT BIOLOGY*
Gong, D., Pomerening, J. R., Myers, J. W., Gustavsson, C., Jones, J. T., Hahn, A. T., Meyer, T., Ferrell, J. E.
2007; 17 (1): 85-91
- **A clear view of the cell cycle [book review]** *Curr Biol*
Ferrell JE Jr.
2007; 17: R231-R232
- **Journal club: a systems biologist encourages modelling by the millions** *Nature*
Ferrell, j. E.
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Yue, J., Ferrell, J. E.
2006; 26 (14): 5300-5309
- **B-Raf and C-Raf are required for Ras-stimulated p42 MAP kinase activation in Xenopus egg extracts** *ONCOGENE*
Yue, J., Xiong, W., Ferrell, J. E.
2006; 25 (23): 3307-3315
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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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- **Investigating macromolecules inside cultured and injected cells by in-cell NMR spectroscopy** *NATURE PROTOCOLS*
Serber, Z., Selenko, P., Haensel, R., Reckel, S., Loehr, F., Ferrell, J. E., Wagner, G., Doetsch, V.
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Kim, S. Y., Song, E. J., Lee, K. J., Ferrell, A. E.
2005; 25 (23): 10580-10590
- **Interlinked fast and slow positive feedback loops drive reliable cell decisions** *SCIENCE*
Brandman, O., Ferrett, J. E., Li, R., Meyer, T.
2005; 310 (5747): 496-498
- **Systems-level dissection of the cell-cycle oscillator: Bypassing positive feedback produces damped oscillations** *CELL*
Pomerening, J. R., Kim, S. Y., Ferrell, J. E.
2005; 122 (4): 565-578
- **STIM is a Ca²⁺ sensor essential for Ca²⁺-store-depletion-triggered Ca²⁺ influx** *CURRENT BIOLOGY*
Liou, J., Kim, M. L., Heo, W. D., Jones, J. T., MYERS, J. W., Ferrell, J. E., Meyer, T.
2005; 15 (13): 1235-1241

- **Allelic variants of the canine heavy neurofilament (NFH) subunit and extensive phosphorylation in dogs with motor neuron disease** *JOURNAL OF COMPARATIVE PATHOLOGY*
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.
2005: 29-54
- **Identification and comparative analysis of multiple mammalian Speedy/Ringo proteins** *CELL CYCLE*
Cheng, A., Xiong, W., Ferrell, J. E., Solomon, M. J.
2005; 4 (1): 155-165
- **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.
2004; 14 (17): 1581-1586
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Gong, D. Q., Ferrell, J. E.
2004; 22 (9): 451-454
- **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.
2004; 22 (3): 306-312
- **Detection of multistability, bifurcations, and hysteresis in a large class of biological positive-feed back systems** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Angeli, D., Ferrell, J. E., Sontag, E. D.
2004; 101 (7): 1822-1827
- **A positive-feedback-based bistable 'memory module' that governs a cell fate decision** *NATURE*
Xiong, W., Ferrell, J. E.
2003; 426 (6965): 460-465
- **Selective regulation of neurite extension and synapse formation by the beta but not the of isoform of CaMKII** *NEURON*
Fink, C. C., Bayer, K. U., MYERS, J. W., Ferrell, J. E., Schulman, H., Meyer, T.
2003; 39 (2): 283-297
- **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.
2003; 5 (4): 346-351
- **Recombinant Dicer efficiently converts large dsRNAs into siRNAs suitable for gene silencing** *NATURE BIOTECHNOLOGY*
MYERS, J. W., Jones, J. T., Meyer, T., Ferrell, J. E.
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- **The JNK cascade as a biochemical switch in mammalian cells: Ultrasensitive and all-or-none responses** *CURRENT BIOLOGY*
Bagowski, C. P., Besser, J., Frey, C. R., Ferrell, J. E.
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- **Enforced proximity in the function of a famous scaffold** *MOLECULAR CELL*
Ferrell, J. E., Cimprich, K. A.
2003; 11 (2): 289-291
- **Self-perpetuating states in signal transduction: positive feedback, double-negative feedback and bistability** *CURRENT OPINION IN CELL BIOLOGY*

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- **Activation of p42 mitogen-activated protein kinase (MAPK), but not c-Jun NH2-terminal kinase, induces phosphorylation and stabilization of MAPK phosphatase XCL100 in Xenopus oocytes** *MOLECULAR BIOLOGY OF THE CELL*
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Deshaies, R. J., Ferrell, J. E.
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 - **Cell cycle - Six steps to destruction** *NATURE*
Ferrell, J. E.
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Bagowski, C. P., MYERS, J. W., Ferrell, J. E.
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 - **Bistability in the JNK cascade** *CURRENT BIOLOGY*
Bagowski, C. P., Ferrell, J. E.
2001; 11 (15): 1176-1182
 - **Bistability in cell signaling: How to make continuous processes discontinuous, and reversible processes irreversible** *CHAOS*
Ferrell, J. E., Xiong, W.
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Bagowski, C. P., Xiong, W., Ferrell, J. E.
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Ferrell, J. E., Xiong, W.
2001; 11 (1): 227-36
 - **Disease attributed to Mycobacterium chelonae in South African clawed frogs (Xenopus laevis)** *COMPARATIVE MEDICINE*
GREEN, S. L., Lifland, B. D., Bouley, D. M., Brown, B. A., Wallace, R. J., Ferrell, J. E.
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 - **Cloning and characterization of Xenopus Rsk2, the predominant p90 Rsk isozyme in oocytes and eggs** *JOURNAL OF BIOLOGICAL CHEMISTRY*
Bhatt, R. R., Ferrell, J. E.
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Ferrell, J. E.
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Walter, S. A., Guadagno, S. N., Ferrell, J. E.
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- **Inhibition of progesterone-induced Xenopus oocyte maturation by Nm23** *Cell Growth Diff*
Kim SY, Ferrell JE Jr., Chae SK, Lee KJ
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Bhatt, R. R., Ferrell, J. E.
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- **Distinct, constitutively active MAPK phosphatases function in Xenopus oocytes: Implications for p42 MAPK regulation in vivo** *MOLECULAR BIOLOGY OF THE CELL*
Sohaskey, M. L., Ferrell, J. E.
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- **Building a cellular switch: more lessons from a good egg** *BIOESSAYS*
Ferrell, J. E.
1999; 21 (10): 866-870
- **Xenopus oocyte maturation: new lessons from a good egg** *BIOESSAYS*
Ferrell, J. E.
1999; 21 (10): 833-842
- **Identification and management of an outbreak of Flavobacterium meningosepticum infection in a colony of South African clawed frogs (Xenopus laevis)** *1997 American-Association-of-Laboratory-Animal-Science Meeting*
GREEN, S. L., Bouley, D. M., Tolwani, R. J., Waggle, K. S., Lifland, B. D., Otto, G. M., Ferrell, J. E.
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Ferrell, J. E.
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Guadagno, T. M., Ferrell, J. E.
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Ferrell, J. E., Machleder, E. M.
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Walter, S. A., Guadagno, T. M., Ferrell, J. E.
1997; 8 (11): 2157-2169
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Ferrell, J. E., Bhatt, R. R.
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Ferrell JE Jr.
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 - **How responses can get more switch-like as you move down a protein kinase cascade** *Trends Biochem Soc*
Ferrell, J. E.
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Huang, C. Y., Ferrell, J. E.
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