JOSEPH RICHARD POMERENING

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EDUCATION

Stanford University School of Medicine
Department of Molecular Pharmacology
Quantitative Chemical Biology Postdoctoral Fellow

University of Illinois at Urbana-Champaign
Graduate College
Ph.D. Molecular and Cellular Biology

University of Wisconsin-Madison
College of Agricultural and Life Sciences (CALS)
B.S. Biochemistry (Honors)

RESEARCH INTERESTS

- Quantitative cellular and molecular biology; perturbing signaling systems, measuring responses using biosensors, live-cell imaging, cytometric methods, and cellular extracts.
- Molecular mechanisms that convert graded stimuli to digital biochemical responses; how signal transduction pathways contribute to all-or-none biological phenomenon.
- Systems-level behaviors of the mitotic oscillator; how the positive- and negative-feedback controls are engineered and their roles in signaling specificity and activity.
- Feedback loops, switches, relays, and other emergent properties of biological systems; pinpointing the loss of feedback controls and associated checkpoints in cancerous contexts.
- Integration of cell cycle and developmental controls; adapting the embryonic oscillator to a somatic oscillator; the links between proliferation and differentiation.
- Computational modeling of signaling systems; understanding emergent behaviors that arise from signal transduction networks, as well as reconstituting biochemical modules *in vitro*.

RESEARCH EXPERIENCE

September 2000 – present

Postdoctoral Research
Stanford University School of Medicine
Department of Molecular Pharmacology
Advisor: James E. Ferrell, Jr., M.D., Ph.D.

- Established that positive feedback is a systems-level requirement of the M-phase circuit in the embryonic context, yielding a bistable CDK switch, as well as a robust CDK oscillator.
- Determined that the requirement for positive feedback in CDK activation is conserved from embryo to somatic cell, using live-cell imaging, cell cycle biosensors, and cytometric analyses.
- Investigating how positive-feedback dictates targeting and timing of CDK activity.
- Applying computational modeling to help predict biological behaviors, to better understand experimental outcomes, and to refine experimental parameters.

RESEARCH EXPERIENCE (continued)

December 1994 - August 2000

Doctoral Research
University of Illinois at Urbana-Champaign
Department of Plant Biology
Advisor: Thomas W. Jacobs, Ph.D.

- Identified binding partners of CDK through protein-protein interaction screening, and characterized its differential phosphorylation of translational elongation factor 1B subunits.
- Performed bioinformatic analyses of the evolutionary divergence in translational elongation factor 1B subunits between plant, animal, and yeast systems; substantiated the evolutionary emergence of eEF1Bβ from eEF1Bα in plants and animals, and its functional correlation as a target of CDK.
- Studied the relatedness and function of wild-type and mutant eEF1Bβs to their eEF1Bα counterpart *in vivo*: only the eEF1Bβ lacking its conserved CDK site replaces eEF1Bα function in *Saccharomyces cerevisiae*.

January 1991 - August 1994

Undergraduate Honors Research
University of Wisconsin-Madison
Department of Biochemistry
Advisor: Richard M. Amasino, Ph.D.

- Screened and genetically characterized early-flowering *Arabidopsis thaliana* mutants.
- Maintained and propagated populations of mutagenized *Arabidopsis thaliana*.

TEACHING EXPERIENCE

Spring 2003

Lecturer - "Evolution and the Origin of Species: Natural Selection and the Molecular Basis of Structure-Function Design in Biology"; "Flora and Fauna: Strategies for Survival"; "Biomimicry";
California College of the Arts
Department of Industrial Design
Biomimicry Course Coordinator: Erez Steinberg

Summer 1999, 2000

Course Developer and Lecturer
Organismic and Cellular Biology
University of Illinois at Urbana-Champaign
College of Liberal Arts and Sciences
Bridge-Transition Director: Dean Ron Woolfolk

Spring 1998

Course Quiz Writer
Biology 121, Ecological and Organismic Biology
University of Illinois at Urbana-Champaign
School of Life Sciences
Coordinator: Melissa Michael

Summer 1997, 1998

Teaching Assistant Trainer
UIUC Teaching Assistant Orientation
University of Illinois at Urbana-Champaign
UIUC Center for Teaching Excellence
Coordinators: Marne Helgesen, Nancy Diamond

TEACHING EXPERIENCE (continued)

Fall 1995 - Spring 2000	*Teaching Assistant* *Biology 121, Ecological and Organismic Biology* University of Illinois at Urbana-Champaign School of Life Sciences Coordinator: Melissa Michael

AWARDS AND HONORS

Fall 2005	International Conference on Systems Biology (ISCB) 2005 Travel Fellowship
Fall 2004 – 2005	Quantitative Chemical Biology (QCB) Fellowship
Spring 2003 - 2004	C.F. Aaron Dean's Fellowship
Summer 2000	Francis M. and Harlie M. Clark Research Support Grant
Spring 2000	University of Illinois Award for Excellence in Undergraduate Teaching
Summer 1999	UIUC Graduate College Dissertation Research Grant
Spring 1999	University of Illinois Award for Excellence in Undergraduate Teaching, *Honorable Mention*
	College of Liberal Arts and Sciences (LAS) Award for Excellence in Undergraduate Teaching
Spring 1999	Advanced Graduate Teaching Certification (AGTC) UIUC Center for Teaching Excellence
Spring 1998	Department of Plant Biology *Excellence in Teaching* Award
	Outstanding Teaching Assistant in Biology 121 Award
November 1997	*Teaching Leadership Award*, Pew Charitable Trusts The Center for Teaching and Learning Services, University of Minnesota-Twin Cities; Department of Plant Biology, University of Illinois at Urbana-Champaign
April 1997	Graduate Teaching Certification (GTC) UIUC Center for Teaching Excellence
Fall 1995 - Spring 2000	Outstanding Teaching Assistant Top 10% of TAs at UIUC, 9/9 teaching semesters
May 1994	Honors Stole Award, (Awarded to Honors Program Graduates, (CALS), University of Wisconsin-Madison

AWARDS AND HONORS (continued)

May 1994	Cardinal Stole Award (Awarded to the Top 20% of Graduates), CALS, University of Wisconsin-Madison
Fall 1991 - Spring 1994	Dean's List, CALS, University of Wisconsin-Madison
Fall 1993 - Spring 1994	CALS Senior Honors Thesis Scholarship University of Wisconsin-Madison
	Mary Shine Peterson Scholarship Department of Biochemistry University of Wisconsin-Madison
Summer 1993	Arabidopsis Training Grant Fellow Program in Cellular and Molecular Biology University of Wisconsin-Madison
Fall 1991 - 1992	Freshman Honors Research Fellowship CALS, University of Wisconsin-Madison

PUBLICATIONS

Pomerening, J.R., Petschnigg, E., Myers, J.W., and Ferrell, Jr., J.E. (*in preparation*). "From Embryo to Adult: Positive Feedback is Essential to Couple Cell Cycle Progression to the CDK1 Oscillator in Somatic Cells." *(for submission to Science).*

Ferrell, Jr., J.E. and Pomerening, J.R. (2005). "Amplitude and Frequency Control in Biological Oscillators." *Nature (in review).*

Pomerening, J.R., Kim, S.Y., and Ferrell, Jr., J.E. (2005). "Systems-level Dissection of the Cell Cycle Oscillator: Bypassing Positive Feedback Produces Damped Oscillations." *Cell* 122: 565-578.

Pomerening, J.R., Sontag, E.D., and Ferrell, Jr., J.E. (2003). "Building a Cell Cycle Oscillator: Hysteresis and Bistability in the Activation of Cdc2." *Nature Cell Biology* 5: 346-51.

Pomerening, J.R., Valente, L., Kinzy, T.G., and Jacobs T.W. (2003). "Mutation of a Conserved CDK Site Converts a Metazoan Elongation Factor 1Bβ Subunit into a Replacement for Yeast eEF1Bα." *Molecular Genetics and Genomics* 269: 776-88.

Pomerening, J.R. (2002). "Teaching in the Laboratory and Discussion: Promoting Education in a Dynamic Environment." *Ready to Teach: Graduate Teaching Assistants Prepare for Today and for Tomorrow*, 57-63, New Forums Press, Inc.

INTERNATIONAL AND NATIONAL MEETING PRESENTATIONS

Pomerening, J.R., Petschnigg, E.M., and Ferrell, J.E., Jr. (2005). Bypassing the Positive-Feedback Loops in Cdc2 Activation Uncouples the Biochemical Oscillator from Mitotic Progression." *The American Society for Cell Biology – 45th Annual Meeting*, San Francisco, CA.

INTERNATIONAL AND NATIONAL MEETING PRESENTATIONS (continued)

Pomerening, J.R. and Ferrell, J.E., Jr. (2005). "From Embryo to Adult: Positive Feedback is Crucial to the Systems Logic of the Mitotic Oscillator." *Wadsworth Division of Molecular Medicine Seminar*. The Wadsworth Center, New York State Department of Health, Albany, NY. *(Invited seminar)*

Pomerening, J.R. and Ferrell, J.E., Jr. (2004). "Positive Feedback is an Essential Feature Embedded Within the M-phase Circuit." *International Federation of Nonlinear Analysts: World Conference of Nonlinear Analysts 2004*, Orlando, FL. *(Invited seminar)*

Pomerening, J.R. and Ferrell, Jr., J.E. (2004). "Regulating the Oscillator: Positive Feedback is an Essential Relay Feature Embedded Within the M-phase Circuit." *The Cell Cycle-Cold Spring Harbor Laboratory*, Cold Spring Harbor, NY.

Pomerening, J.R. and Ferrell, J.E., Jr. (2003). "Hysteresis and Bistability in Cdc2 Activation: Constructing a Cell Cycle Oscillator." *Mathematical Biosciences Institute (MBI): "Control of Cell Growth, Division and Death" Workshop*, Ohio State University, Columbus, OH. *(Invited seminar)*

Pomerening, J.R. and Ferrell, Jr., J.E. (2002). "Quantitative Analyses of MPF Activation and Stability in Xenopus Egg Extracts Reveal its Inherent Bistable Response." *The Cell Cycle-Cold Spring Harbor Laboratory*, Cold Spring Harbor, NY.

Pomerening, J.R. and Jacobs, T.W. (2000). "Coordination of Cell Cycle Control and Translational Elongation." *UCSF Cardiovascular Research Institute Special Seminar*, San Francisco, CA.

Pomerening, J.R. and Jacobs, T.W. (1999). "Interaction Between CDK and Translational Elongation Factor Subunit eEF1Bβ." *1999 National Plant Protein Phosphorylation Workshop*, Salt Lake City, UT.

Pomerening, J.R. and Jacobs, T.W. (1998). "Protein Synthesis and the Cell Cycle." *American Society of Plant Physiologists (Midwest Section)*, Dekalb, IL.

Pomerening, J.R. (1997). "Teaching in the Laboratory: Promoting Education in a Dynamic Environment." *The Sixth National Conference on the Education and Employment of Graduate Teaching Assistants*, Minneapolis, MN.

Pomerening, J.R., Wakeley, P.R., Roush, T., Duncan, T., Lieberman, D., and Jacobs, T.W. (1997). "Phosphorylation in the Control of Cell Division in Plants." *1997 National Plant Protein Phosphorylation Workshop*, Jackson Hole, WY.

Pomerening, J.R. and Amasino, R. (1993). "Isolation and Genetic Characterization of Early-Flowering Putants of *Arabidopsis thaliana*." *Argonne National Symposium for Undergraduate Research*, Argonne, IL.