Daniel P. Aalberts

Department of Physics, Williams College, Williamstown MA 01267

413-597-3520, aalberts@williams.edu, http://panic.williams.edu/

Education

Massachusetts Institute of Technology

Awarded Ph.D. in Theoretical Statistical & Condensed Matter Physics Sept. 1994

Thesis: *Phase Transition Phenomena in Quantum Spin Systems and in Polyampholyte Gels* supervised by Professor A. Nihat Berker.

Massachusetts Institute of Technology

Awarded S.B. in Physics. June 1989

Thesis: *Modeling the Behavior of the Relativistic Magnetron* supervised by Professor George Bekefi and Dr. Shien-Chi Chen.

Experience

Williams College

Department Chair, Department of Physics January 2011—June 2013

Professor, Department of Physics July 2009—present

Associate Professor, Department of Physics July 2003—June 2009

Assistant Professor, Department of Physics Sept. 1997—June 2003

Full listing of courses taught/developed and research conducted/supervised follows.

Rockefeller University, Center for Studies in Physics and Biology

Visitor Fall 2000

Fellow Sept. 1996—Aug. 1997

RNA/DNA pairing kinetics, lipid bilayer simulations, polyene vibrations, polymer reptation, and gel crosslink diffusion. In 1997, organized the Center's weekly seminar series.

University of Leiden

Postdoctoral Fellow Sept. 1994—Aug. 1996

Studied models for how charged polymers such as DNA move through a gel due to an applied field. Began rhodopsin research. Organized "Werkbespreking" internal seminar series. Supervised by Professors Hans van Leeuwen and Wim van Saarloos.

Massachusetts Institute of Technology

Graduate Research Assistant 1990—1994

Teaching Assistant Spring 1994

Graduate Quantum Mechanics. Helped students, prepared solutions, graded homework.

Recitation Instructor Jan. 1990, 1991, 1992

Taught recitation sections, graded homework, wrote solutions for three separate intensive one-month classes: *Superconductivity*; *Phase Transitions and Renormalization-Group Theory*; and *Neural Networks, Simulated Annealing, and Phase Transition Models*

Graduate Resident Tutor 1990—1994

Resided with 34 undergraduates at MIT's East Campus Dormitory. Provided academic tutoring, counselling, and support while serving as a resource in times of need.

Lawrence Livermore National Laboratory

Physicist Summer 1989, 1990

Experimental relativistic klystron research. Supervised by Dr. Glen Westenskow.

COURSES TAUGHT

Williams College

†*Condensed Matter Physics* (Physics 451) Spring 2016
3 hours lecture/discussion

†*Computational Biology* (Physics/Comp Sci 315T) Fall 2014, Spring 2018
3 hour lab, plus 5 weekly tutorial meetings

†*Statistical Physics* (Physics 302) Spring 2002—2004, 2006, 2007, 2011, 2012, 2015
5 hours classroom contact per week, including weekly laboratory

†*Facts of Life* (Physics 231T) Fall 2012
6 hours classroom contact per week

Introduction to Mechanics (Physics 131) Fall 2010, 2011
6 hours classroom contact per week, including bi-weekly laboratory

†*Seminar in Modern Physics* (Physics 151) Fall 2005—2007, 2015, 2016
6 hours classroom contact per week, including weekly laboratory or conferences

†*Computational Biology* (Physics/Comp Sci 315) Fall 2003, Spring 2008, 2013, 2017
5 hours classroom contact per week, including weekly laboratory

Mathematical Methods for Scientists (Physics 210) Spring 2002, 2003, 2008, 2016, 2018
3 hours classroom contact per week

†*Materials Science* (Chem/Physics 332) Spring 2004
3 hours classroom contact per week

Sound, Light, and Perception (Physics 109) Fall 2003
3 hours classroom contact per week

†*The Making of the Atomic Bomb* (Physics 014) Jan. 2002, 2015
8 hours classroom contact per week

Particles and Waves — Enriched (Physics 141) Fall 2001, 2002, 2006 (lab)
11 hours classroom contact per week, including introductory laboratory

Electromagnetism and the Physics of Matter (Physics 132) Spring 1998—2000
9 hours classroom contact per week, including introductory laboratory

†*Science of Sports* (Physics 018) Jan. 1999
7 hours classroom contact per week

†*Electricity and Magnetism* (Physics 201) Fall 1997, 1999
3 hours classroom contact per week

†*Electromagnetic Theory* (Physics 405T) Fall 1997, 1999, 2017
7 hours classroom contact per week

†*Classical Mechanics and Fluid Mechanics* (Physics 411T) Fall 1998
9 hours classroom contact per week

† indicates a course I created or substantially revised

Grants

National Institutes of Health AREA Grant (R15GM106372) 6/14–5/18
Optimizing gene expression with mRNA free energy modeling and algorithms
N.I.H. $255,304. Total $255,304.

National Institutes of Health AREA Grant (R15GM080690) 7/07–6/11
Binding and Splicing mRNA
N.I.H. $226,479. Total $226,479.
plus N.I.H. supplement $79,200. Total $79,200. 9/09–8/11

National Science Foundation RUI Grant (MCB-0641995) 2/07–1/11
Improving RNA Pseudoknot Models and Algorithms
NSF $260,819 Total $260,819.

National Institutes of Health AREA Grant (R15GM068485) 7/03–6/06
Splicing, Folding, and Strecthing Nucleic Acids
N.I.H. $155,183. Total $155,183.

Cottrell College Science Grant from the Research Corporation 7/00–8/04
Quantum coherent dynamics of photoactive molecules
Research Corp. $37,500. Total $43,500.

Tutorial Development Grant 2014
Computational Biology (Phys/CSci 315T)

Critical Reasoning and Analytical Skills (CRAAS) Grant 2005
Seminar in Modern Physics (Phys 151)

Course Development Grant 2003
Computational Biology (Phys/CSci 315)

Critical Reasoning and Analytical Skills (CRAAS) Grant 2003
Sound, Light, and Perception (Phys 109)

Course Development Grant 2001
Statistical Physics (Phys 302)

Tutorial Development Grant 1998
Classical Mechanics and Fluid Mechanics (Phys 405T)

Honors

Jefferson High School Hall of Fame	1999
National Science Foundation Graduate Fellow	1989–1993
Awarded Dept. of Energy Magnetic Fusion Science Fellowship	1989
Elected to Sigma Pi Sigma, MIT	1989
Elected to Sigma Xi, MIT	1989
IBM T.J. Watson Scholar	1985–1989
National Merit Scholar	1985–1986

PUBLICATIONS AND RESEARCH

underlined =undergrad co-author

† = corresponding author

Codon Clarity or Conundrum? by Daniel P. Aalberts, Grģory Boël, and John F. Hunt. *Cell Systems* **4**, 15-19 (2017) [doi:10.1016/j.cels.2017.01.004]

Codon influence on protein expression correlates with E. coli mRNA levels by Grégory Boël, Reka Letso, Helen Neely, W. Nicholson Price, Kam-Ho Wong, Min Su, Jon D. Luff, Mayank Valecha, John K. Everett, Thomas B. Acton, Rong Xiao, Gaetano T. Montelione, Daniel P. Aalberts†, & John F. Hunt†, *Nature* **529**, 358–363 (2016). Codon usage and folding free energy influence protein expression.

mRNA sequence features controlling protein expression by G. Boël, G.T. Montelione, D.P. Aalberts, & J.F. Hunt, *Cell Systems* **2**, 60 (2016).

Visualizing RNA secondary structure base pairing probabilities by William K. Jannen and Daniel P. Aalberts†. 2015 BioVis Design Challenge Finalist. Introducing the AllPairsMFE RNAbow diagram.

U.S. Patent Cooperation Treaty PCT/US2015/033622 *Methods for altering polypeptide expression* John Hunt, Daniel P. Aalberts, and Gregory Böel co-inventors (Dec 2015). Uses codon usage, free energy, and composition terms to optimize protein expression.

Visualizing RNA base-pairing probabilities with RNAbow diagrams by Daniel P. Aalberts† and William K. Jannen, RNA **19**, 475–478 (2013). Includes partition function weights and makes it possible to compare structures at a glance.

Free energy cost of stretching mRNA hairpin loops inhibits small RNA binding by Yuzhong Meng and Daniel P. Aalberts†, Biophys. J. **104**, 482–487 (2013).

Loop Entropy assists tertiary order: Loopy stabilization of stacking motifs by Daniel P. Aalberts, Entropy, **13**, 1958–1966 (2011). Surprisingly, the disorder of loops drives tertiary order.

A two length scale polymer theory for RNA loop free energies and helix stacking by Daniel P. Aalberts† and Nagarajan Nandagopal, RNA **16**, 1350–1355 (2010) A proper polymer theory of multibranch loops improves prediction accuracy of RNA folding algorithms.

A vision for ultrafast photoisomerization by Daniel P. Aalberts† and Hans F. Stabenau. Physica A **389**, 2981–2986 (2010). Double bonds inhibit twisting, but π-π coulomb interactions weaken torsional restoring forces and diminish isomerization barriers.

Quantifying optimal accuracy of local primary sequence bioinformatics methods by Daniel P. Aalberts†, Eric G. Daub, and Jesse W. Dill, Bioinformatics **21**, 3347 (2005). The intrinsic limitations in local bioinformatics methods are quantified with a scaling study. Our new PSR method is more accurate than other methods.

Asymmetry in RNA pseudoknots: Observation and Theory by Daniel P. Aalberts† and Nathan O. Hodas, Nucleic Acids Res., **33**, 2210–2214 (2005). Asymmetries in the stem and loop lengths and provocative loop composition differences between are observed, then explained with a simple polymer physics model and statistical mechanical theory.

Efficient computation of optimal oligo–RNA binding by Nathan O. Hodas and Daniel P. Aalberts†, Nucleic Acids Res. **32**, 6636 (2004). Interaction free energies for nucleic acid associations are calculated with a new, faster algorithm.

Thermodynamic modeling of donor splice site recognition in pre-mRNA by Jeffrey A. Garland and Daniel P. Aalberts†, Phys. Rev. E. **69** 041903 (2004) Uses association free energies to identify splice sites.

Multiple coexistence loops of polyampholyte gels from a random-field model by Daniel P. Aalberts and A. Nihat Berker†, Bull. Istanbul Tech. Univ **53**, 2 (2003). Provides a model to explain experimental results on gels with random anionic and cationic groups.

Single-strand stacking free energy from DNA beacon kinetics by Daniel P. Aalberts†, John M. Parman, Noel L. Goddard, Biophys. J. **84**, 3212 (2003) Stacking of single-

strand nucleotides strongly influences hairpin formation rates. Free energies are calculated via comparison of DNA beacon experiments and Monte Carlo simulations.

Quantum coherent dynamics of molecules: a simple scenario for ultrafast photoisomerization by Daniel P. Aalberts†, M. S. L. du Croo de Jongh, Brian F. Gerke, and Wim van Saarloos, Phys. Rev. A **61**, 040701(R) (2000). Absorbing a photon upsets the balance between competing twisting forces: a rapid molecular shape change results.

Towards understanding the ultrafast dynamics of rhodopsin by Daniel P. Aalberts, Fernando L.J. Vos, and Wim van Saarloos†, Pure Appl. Chem **69**, 2099 (1997). A three dimensional model for conjugated polymers is developed and applied to rhodopsin. Model parameters are determined from vibration spectra and structural measurements.

Reptation in a weak driving field by Daniel P. Aalberts and J.M.J. van Leeuwen†, Physica A **236**, 220 (1997). The field-induced orientation of the path which a charged polymer follows through a gel is studied in a systematic expansion of the probability distribution. Correlations between segments are shown to be large even for weak fields.

The Su–Schrieffer–Heeger model applied to chains of finite length by Fernando L.J. Vos, Daniel P. Aalberts, and Wim van Saarloos†, Phys. Rev. B **53**, 14922 (1996). The influence of boundaries in this model for conjugated polymers is studied. Elementary excitations and dynamics are described.

Monte Carlo study of polyelectrolyte gels by Daniel P. Aalberts, J. Polym. Sci. B **34** 1127 (1996). Simulations show scaling properties and phase transitions in gels.

Dynamic symmetry breaking in a model of polymer reptation by Daniel P. Aalberts and J.M.J. van Leeuwen†, Electrophoresis **17**, 1003 (1996). A sufficiently strong electric field will drive a charged polymer to spontaneously orient with a head and with a tail. The critical field is found to be a non-trivial power of the chain length.

Microscopic simulation of phase transition in interacting ionic gels by Daniel P. Aalberts, J. Chem. Phys. **104**, 4309 (1996). A first-order phase transition separating swollen and collapsed phases is observed, and a method to preserve ergodicity is introduced.

A simple method for calculating the speed of sound in one-dimensional tight-binding models: application to the Su–Schrieffer–Heeger model by Fernando L.J. Vos, Daniel P. Aalberts, and Wim van Saarloos†, Phys. Rev. B **53**, R5986 (1996). We calculate the electronic suppression of the speed of sound exactly, correcting the incorrect result often quoted in the literature.

Electrophoretic mobility of asymmetric reptating polymers by Daniel P. Aalberts, Phys. Rev. Lett. **75**, 4544 (1995). The velocity of chain molecules driven through a gel depends on chain length; here I show that an asymmetric molecule's dynamics may complement their symmetric counterparts.

Entanglement transition in the two-dimensional quantum XY model by D.P. Aalberts, Phys. Rev. B **49**, 7040 (1994). New order parameters and local symmetry operations for Quantum Monte Carlo are invented and I show that Kosterlitz-Thouless scaling is obeyed at the transition.

Spin-wave bound-state energies from an Ising model by Daniel P. Aalberts and A. Nihat Berker†, Phys. Rev. B **49**, 1073 (1994). We map a fully quantum mechanical problem in 1-D to a classical problem in (1+1)-D, then calculate energy spectra.

Recent progress in relativistic klystron research by M. Allen *et al.*, Part. Accel. **30-31**, 1147 (1990). Reports on experimental development of a high-power microwave source.

THESIS STUDENTS

Brian Gerke '99 — Summer 1998–Summer 1999
Ultrafast Photoisomerization Dynamics
[**APS Apker Award, best B.A. research.**]
M. Phil. at Cambridge Univ, Ph.D. at Berkeley 2008

Ben Cooper '01 — Summer 1999–Spring 2001
Color Tuning Through Mechanical Stretching in Polyacetylene
Ph.D program at Maryland

Fritz Stabenau '02 — Jan. 2000–Spring 2002
Photoisomerization and Structural Competition in Polyenes
Ph.D 2008 at Pennsylvania

John Parman '02 — Fall 2001–Spring 2002
A Monte Carlo Study of DNA Beacon Kinetics
Ph.D 2008 at Northwestern (Economics)

Jeff Garland '03 — Summer 2002–Fall 2003
Thermodynamic Modeling of Splice Site Recognition in pre-mRNA
M. Phil program at Cambridge Univ (Classics); Harvard Law.

Nathan Hodas '04 — Summer 2002–Spring 2004
The Stacked or Freely Jointed Chain: Single-Stranded Stacking in Nucleic Acids
[**APS Apker Award, best B.A. research.**]
Ph.D 2011 at Caltech.

Eric Daub '04 — Summer 2003–Spring 2004
The Primary Sequence Limit of pre-mRNA Splice Site Detection
Ph.D 2009 at the University of California, Santa Barbara.

Rob Cooper '06 — Summer 2005–Spring 2006
Role of mRNA Secondary Structure in Gene Regulation
Ph.D 2011 molecular biology at Princeton University.

Alex Zaliznyak '07 — Fall 2006–Spring 2007
Levy Flights and Scale Invariance in Stochastic Searches
Ph.D program at Stanford (Economics)

Sandy Nandagopal '09 — January 2007–Summer 2009
Thermodynamic Applications of RNA-Binding
Improving Models of RNA Loops
Ph.D program at Caltech

Becca Sullivan '11 — Summer 2010–Spring 2011
Database of Reference RNA Structures in Thermal Equilibrium
NYC Teaching Fellow

Jeff Meng '11 — Spring 2010–Spring 2011
MicroRNA binding
Whitehead Institute (MIT), Harvard Medical School.

Joel Clemmer '12 — Summer 2011–Spring 2012
Base Composition and Probability of Pairing
Ph.D program in Biophysics at Johns Hopkins

Julian Hess '13 — Summer 2011–Spring 2013
RNABOWS *visualization tool,* BINDIGONET *algorithm*
Broad Institute

Mike Flynn '15 Summer 2014–
Improved stochastic sampling algorithm, building RNA folding macrostates
Analysist at Hutchin-Hill Capital, then Caltech

Bijan Mazaheri '16 Summer 2015–
RNA macrostates and kinetics
Cambridge Univ, then Caltech.

Daniel Wong '17 January 2015–
Secondary Structure and Protein Translation
Cambridge Univ.

Intekhab Hossain '17 Summer 2016–
Codon Influence Models: a Comparative Genomics Approach
Analyst, Analysis Group Boston

Nikolaus Howe '17 Summer 2016–
Efficient Calculation of RNA Secondary Structures with Terminal Stacking
Cambridge Univ.

Eliza Matt '18 Summer 2017–
The Energy Spectrum of RNA Secondary Structures

Research Students

Ian Eisenman '99 Jan. 1999–Dec. 1999
Brachistochrone with Coulomb Friction
M. Sc. at Santa Barbara, Ph.D at Harvard 2008

Jonathan Pyle (Swarthmore '99) Summer 1998
Modeling the Photoisomerization of Retinal
J. D., admitted to Pennsylvania bar

Qiang Sun '00 Summer 1998
Photoexcited States of Conjugated Polyenes
software engineer, Seibel systems

John Parman '02 Summer 2000
Lipid Bilayer Simulations
Ph.D in Economics at Northwestern University. Now Asst. Prof. at William and Mary.

Rachel Horwitz '03 Summer 2000
Structure of Folded Proteins
Ph.D in Physical Oceanography at MIT/Woods Hole

Kristina Weyer '03 Summer 2001
DNA Beacons
M.E. in Mechanical Engineering, University of Colorado

Mike Baiocchi '03 Summer 2001
Numerical Simulations in Statistical Physics
Ph.D. in Statistics, University of Pennsylvania. Now Asst. Prof. at Stanford.

Jesse Dill '04 Summer 2004
Primary Sequence Ranking
Ph.D in biophysics, UC Berkeley.

Evan Miller '06 Summer 2005
Abundance of Pseudoknots in the RNA World
Ph.D program in Economics at Univ. of Chicago

Rob Terchunian '06 — Summer 2005
Base Stacking Interactions in Single-Stranded RNA
Navy Intelligence

Will Parker '08 — Summer 2007
Secondary structure and mRNA splicing
M.D. at U. Chicago

Teng Jian Khoo '09 — January 2006—Spring 2008
Thermodynamics of High Density Microarrays, *Abundance of Pseudoknots*
Ph.D High Energy Physics Cambridge Univ. (2014)

Jerry He '08 — Fall 2007
RNA pseudoknot structures

Scott Olesen '10 — Fall 2006—Spring 2007
Cancer Rates, Body Mass Index Scaling
MIT Ph.D. (2016)

Steven Jackson '10 — Summer 2008
Statistics of RNA Loops
Princeton Ph.D. program

Becca Sullivan '11 — Summer 2008
RNA Splice Sites: Distributions of Codon Frames
NYC Teaching Fellow

Antoniya Aleksandrova '11 — Summer 2009
Base Pairing Probability
Cambridge Univ. Biophysics Ph.D. (2016)

Olivia Uhlman '13 — Summer 2012
Facts of Life
Teaching at St. Sebastian's school in Needham, MA

Ashwin Narayan '16 — Summer 2014
An observation of and explanation for symmetry breaking in microRNA base composition
Ph.D program at MIT (applied math).

Samantha Petti '15 — Spring 2015
Geometrical constraints on RNA pseudoknots
Ph.D program at Georgia Tech.

Ian Banta '19 — Summer 2017
RNA Microstate Kinetics

Conference Presentations

Synonymous mutations to increase protein yield poster with Daniel P. Wong '17, *Transcriptional Codon-Influence Models for E. coli and B. subtilis* poster with Intekhab Hossain '17, *Multiplicity of Microstates: Terminal Stacking in RNA Secondary Structures* poster with Niki Howe '17, at the RNA Symposium, Univ. Albany, 2017.

RNA Secondary Structure Macrostates poster with Bijan Mazaheri '16, *Synonymous mutations improve protein yield* poster with Daniel Wong '17, *Efficient sampling of RNA secondary structures* poster with Michael Flynn '15 at The RNA Symposium, U. Albany, 2016.

RNA features controlling protein expression level in E. coli talk at RNA2015, Benasque, Spain.

Intuitive ways of visualizing RNA macrostates talk at RNA2015, Benasque, Spain.

RNA features controlling protein expression level in E. coli talk at The RNA Symposium, U. Albany, 2015.

RNA features controlling protein expression level in E. coli poster at Translation Control Meeting, Cold Spring Harbor Lab, 2014.

Modeling unpairing costs for fast computation of the net binding free energy of an oligo to an mRNA target poster at Biophysical Society Meeting, 2014.

Computing Effective Free Energy to Bind an Oligo to an mRNA: the Bindigo-MFT *algorithm* poster at RNA Symposium, Finger Lakes RNA retreat, 2013.

RNAbows: *an intuitive tool for RNA structure visualization* poster at poster at RNA Symposium, U Albany, 2011.

Computing Effective Free Energy to Bind an Oligo to an mRNA: the Bindigo-MFT *algorithm* poster at RNA Symposium, U Albany, 2011.

Base Pairing Probability and Composition Asymmetry in RNA poster at RNA Symposium, U Albany, 2011.

RNAbows: *an intuitive tool for RNA structure visualization* poster at Posttranscriptional Gene Expression Gordon Conference, Newport, 2010.

Mending Multibranch Loops poster at Nucleic Acids Gordon Conference, Newport, 2008.

Abundance of RNA pseudoknots: theory and observation poster at Nucleic Acids Gordon Conference, Newport, 2007.

Abundance of pseudoknots in the RNA World at American Physical Society March Meeting, Baltimore, 2006.

Asymmetry in RNA pseudoknots: observation and theory poster at Nucleic Acids Gordon Conference, Newport, 2005.

Quantifying optimal accuracy of local primary sequence bioinformatics methods at American Physical Society March Meeting, Los Angeles, 2005.

Thermodynamic modeling of donor splice site recognition in pre-mRNA at American Physical Society March Meeting, Montreal, 2004.

Bioinformatics in the thermodynamic limit: applications to pre-mRNA splice site detection at American Physical Society March Meeting, Montreal, 2004. (Eric G. Daub '04 and DPA)

Calculating optimal binding of two nucleic acid chains American Physical Society March Meeting, Montreal, 2004. (Nathan O. Hodas '04 and DPA)

Single-strand stacking free energy from DNA beacon kinetics at American Physical Society March Meeting, Austin, 2003.

Mechanically tuning the color of polyacetylene at American Physical Society March Meeting, Indianapolis, 2002.

A Monte Carlo study of DNA beacon kinetics at American Physical Society March Meeting, Indianapolis, 2002. (John M. Parman '03 and DPA)

Competing intramolecular forces in polyenes at American Physical Society March Meeting, Indianapolis, 2002. (Hans F. Stabenau '03 and DPA)

Quantum coherence in photoexcited polyenes at American Physical Society March Meeting, Minneapolis, 2000.

A theory of ultrafast photoisomerization, the first step in vision at American Physical Society Centennial Meeting, Atlanta, 1999.

Towards understanding the ultrafast dynamics of rhodopsin at 11th International Symposium on Carotenoids, 1996.

Towards understanding the ultrafast dynamics of rhodopsin, the Molecule that Makes Us See at Condensed Matter-Optical Physics Meeting, Lunteren, 1996.

Electrophoretic mobility of an asymmetric reptating polymer and *Dynamic Symmetry Breaking in a Model of Polymer Reptation* at the American Physical Society March Meeting, St. Louis, 1996.

The Su–Schrieffer–Heeger model applied to chains of finite length at the American Physical Society March Meeting, St. Louis, 1996. (F.L.J. Vos, DPA, W. van Saarloos)

A new method for gel electrophoresis: the old ball and chain at the Bi-Annual Statistical Mechanics Meeting, Rutgers University, 1995.

Phase transition studies in ionic gels at the Dutch national statistical physics meeting, Lunteren, 1995.

Microscopic simulation of phase transition in interacting ionic gels and *Multiple coexistence loops of polyampholyte gels from a Random-Field Model* at the American Physical Society March Meeting, San Jose, 1995.

Entanglement transition in the two-dimensional quantum XY model and *Spin-wave bound-state energies from an Ising model* at the American Physical Society March Meeting, Pittsburgh, 1994.

Entanglement transition in the two-dimensional quantum XY model at the Bi-Annual Statistical Mechanics Meeting, Rutgers University, 1993.

Hard-spin mean-field theory: variational free energy and first-order phase transitions at the American Physical Society March Meeting, Indianapolis, 1992.

Seminars

The mRNA sequence features controlling protein expression in E coli at Free Univ., Berlin.

How mRNA modulates gene expression at Ohio State Univ., 2015.

Somewhere over the RNAbow, a new way to describe RNA free energy landscapes at Mt. Holyoke College, 2015.

A Universal Formula for RNA Loops at New England Complex Fluids, 2013.

Intuitive Ways of Visualizing RNA Folds and Landscapes at Boston College, 2012.

Introducing Zfold: Somewhere over the RNAbow at Williams College (Computer Science and Physics), 2010.

Loopy Entropy-Driven Order at University of Albany, 2009.

Loopy Stabilization of RNA Loops: How Entropy Creates Order at Williams College (Chemistry Department), 2009.

Loopy Stabilization of RNA Loops: How Entropy Creates Order at Swarthmore, 2009.

Loopy Entropically-Driven Order at MIT, 2009.

A Universal Formula for RNA Loops at University of Rochester, 2009.

Asymmetry of Pseudoknots and the Mystery of Mysteries at Northeastern Univ, 2008.

Asymmetry of RNA Pseudoknots: Observation and Theory at RPI, 2008.

Finding with Binding and Ranking at Brown University, 2008.

Finding with Binding at St. John's University, 2007.

Asymmetry of RNA Pseudoknots: Observation and Theory at Fairfield University, 2007.

Asymmetry and Abundance of RNA Pseudoknots at Leiden University, 2006.

Splicing messenger RNA at Ludwig Maximilians Universität München, 2006.

Asymmetry and Abundance of RNA Pseudoknots at Technical Univ. of Munich, 2006.

Asymmetry and Abundance of RNA Pseudoknots at the University of Cologne, 2006.

Asymmetry and Abundance of RNA Pseudoknots at Williams College Biology, 2006.

Splicing messenger RNA at Amherst College, 2005.

Statistical mechanical modeling of mRNA splice site identification at University of Illinois at Chicago, 2005.

Single-strand stacking free energy from beacon kinetics at Univ. of Pennsylvania, 2005.

Identifying donor splice sites in pre-mRNA with thermodynamics and statistics at MIT (Burge Lab), 2004.

DNA molecular beacon kinetics and single-strand stacking energies at Istanbul Technical Univ, 2003.

Ultrafast photoisomerization: the first step in vision at Istanbul Technical Univ, 2003.

Single-strand stacking free energy from DNA beacon kinetics at U. Mass, Amherst, 2002.

Competing molecular forces and the first step in vision at Simons Rock, 2001.

A simple scenario for ultrafast photoisomerization at Center for Studies in Physics and Biology, Rockefeller University, 2000.

Ultrafast photoisomerization, the first step in vision at Colgate College, 2000.

Ultrafast coherent dynamics of photoexcited molecules, the First Step in Vision at MIT, 1999.

Modeling the ultrafast dynamics of rhodopsin at Amherst College, 1998.

Ultrafast dynamics of rhodopsin at Lucent Technologies, 1997.

Electrophoretic mobility of asymmetric reptating polymers, a.k.a. the old ball and chain at University of Iowa, 1996.

Towards understanding the ultrafast dynamics of rhodopsin, the molecule that makes us see at University of Iowa, 1996.

Towards understanding the ultrafast dynamics of rhodopsin, the molecule that makes us see at Rockefeller University, 1996.

Solitonic excitations in rhodopsin at Biophysics Seminar, Utrecht, 1996.

Multiple phases in random ionic gels at Iowa State University, 1995.

Phase transition studies in polyampholyte gels at University of Washington, 1995.

Multiple phases in random ionic gels at Chez Pierre Seminar, MIT, 1995.

Quantum statistical mechanics and the extra dimension at the Landelijk Seminarium, Amsterdam, 1994.

Quantum statistical mechanics and the extra dimension at the Seminarium Theoretische Natuurkunde, Leiden, 1994.

SUMMER SCHOOLS

Chautauqua Bioinformatics at RPI 2004
NEC Biophysics Lectures: Complex Networks 2002
accompanied by thesis students Jeff Garland '03 and Nathan Hodas '04
NEC Biophysics Lectures: Genomics 1998
NEC Biophysics Lectures: Proteins 1996
NEC Biophysics Lectures: DNA 1994

SERVICE

Committee Service

Calendar and Scheduling Committee 2015–2016
Faculty Compensation Committee 2006–2007
Faculty Lecture Committee 2005–2006, 2009–2010, 2017–2018
Committee on Priorities and Resources 2003–2004
Honorary Degrees Committee 2003–2004, 2011–2013
‡*Faculty Review Panel* 2002–2004
‡*Committee on Educational Policy* 2001–2003
Co-chair Quantitative/Formal Reasoning Reqiurement sub-committee
Experiential Education sub-committee
Lecture Committee 1999–2000
Information Technology Committee 1998–1999
Science Executive Committee 1998–1999, 2011–2013
Premedical Advisory Committee 1998–2000

‡ signifies a position to which one is elected by faculty vote

Other College Service

First Year Advisor 1998–present
Major Advisor 1998–present
Interdepartmental Program in Bioinformatics, Proteomics, and Genomics 2002–present
Founding member
Interdepartmental Program in Material Science 1998–present
Founding member

Departmental Service

Chair 2011–2013
Society of Physics Students Chapter Advisor 1997–2007
Tenure track hiring committee 1999–2000, 2000–2001, 2002–2003, 2007–2008, 2015
Visiting position hiring committee 1998, 2000, 2004, 2011
Davis Foundation: Outcomes Assessment Study 2001

Professional Activities/Service

Reviewer for Journals: Nucleic Acids Research, Nature Communications, PLoS One, PLoS Computational Biology, Bioinformatics, Europhysics Letters, Physical Review E, Journal of Chemical Physics, Computers in Biology and Medicine, Macromolecules, Journal of Polymer Physics B, Spectrochemica Acta Part A, ACS Transformations.

Other Campus Activities

Play in *Flatbed Jazz Band* with other faculty (2003–present). Co-founded a Williams science faculty *a cappella* quartet *The Diminished Faculty* (1999–2004). Sang classical literature with student/faculty quartet *With and Without* (2001–2003). Participated in IM basketball and broomball. Faculty Dormitory Liason (Currier House 2002–2003).